INDEX TO VOLUME III OF JOINT APPENDIX

	Transcript Pages	Volume	Appendix Pages
ERPT FROM TRANSCRIPT OF PROCEEDINGS:			
estimony of Charles C. Bonin	2055-2077	III	866-882
ts 1-29 of Exhibit L of PNPC Application for License for Middle Snake River ydroelectric Project, Project No. 2243, ed March 31, 1958	25255-25283	III	883-911

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

Nos. 18728, 18729 and 18731

WASHINGTON PUBLIC POWER SUPPLY SYSTEM, STATE OF WASHINGTON, DEPARTMENT OF CONSERVATION, UNITED STATES OF AMERICA EX REL. STEWART L. UDALL, Secretary of the Interior, *Petitioners*,

v.

FEDERAL POWER COMMISSION, *Respondent*.

On Petition for Review of an Order of the Federal Power Commission

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Volume III

Excerpt from Testimony of Charles C. Bonin

2055

By Mr. Wise:

Q. Mr. Bonin, how many engineers have been working on the High Mountain Sheep project? How much of your staff has devoted its time and how much time to it? A. I can't answer that question. I would have to check into all of the records, time sheets of the entire group of civil engineers, electrical engineers, designers and draftsmen.

Q. Will you be able to do that and furnish it to us before the close of your examination, please?

Mr. Hugh Smith: I believe some demonstration of relevance should be made, Mr. Examiner, before the witness is asked to do a job of that sort. Work on this according to the record already goes back to 1957.

2056

Presiding Examiner: Suppose I ask Mr. Wise what the purpose of this information is?

Mr. Wise: If the Examiner please, it seems to me this is extremely relevant for this reason—and I hope Mr. Smith will not accuse me of making a speech, but I know of no way—

Presiding Examiner: I have asked you to state the reason why—to explain why we are doing this.

Mr. Wise: As a layman, my personal observation of the record in this case—and I am so advised by our engineer—makes it crystal-clear that there is no engineering being done here which could possibly result in building the project. Even in the case of High Mountain Sheep, where a much better job has been done than has been done in connection with Lower Canyon, the engineering is so skimpy there that obviously a lot more preliminary work will have to be done, a lot more foundation exploration will have

to be made, and it is going to add up to not in millions but many, many millions of dollars of additional cost.

But when you turn to Lower Canyon, the situation is so absurd there that when I was in our engineers' office and the young engineers would bring the figures to show what they would show, they came in giggling about it, not once but each time.

Presiding Examiner: You are not trying to remedy the inadequacy of the engineer here, are you?

2057

Mr. Wise: I am trying to establish it, if you please, your Honor, to show this is rediculous, a farce, to present an application like this to the Commission.

Presiding Examiner: You are certainly entitled to maintain that position.

Mr. Wise: That is what I am trying to do by this line of questioning.

Presiding Examiner: How does the information you just asked for serve this purpose?

Mr. Wise: It shows the small amount of engineering which has gone into these projects.

Mr. Hugh Smith: You might be rather surprised, Mr. Wise.

Presiding Examiner: I don't follow that.

Mr. Wise: I am sorry, your Honor.

Presiding Examiner: What is the information now that you are asking for?

Mr. Wise: I asked him how much engineering time was devoted to this project. That was the substance of my question. He said he didn't know and he would have to go through the records of the company to tell me. I am asking him to do that and produce those records.

Presiding Examiner: Mr. Smith, you don't have any objection to a summarization. I take it this is not an

audit that we are conducting here, but an estimation or summarization of the time devoted.

2058

Mr. Hugh Smith: As requested, Mr. Examiner, it was an audit. That is exactly what I was objecting to.

Presiding Examiner: I would certainly agree that an audit is not required. But I think that information which would generally indicate the character and nature of the work done and the amount of time involved would be appropriate.

Mr. Hugh Smith: I would ask Mr. Bonin if he thinks it is possible, on the basis of the general records of Ebasco, to produce an estimate of the amount of professional time involved since 19.. the amount of time involved on High Mountain Sheep, Lower Canyon, Nez Perce—both arch and gravity, I suppose all of these are involved in this request, Mr. Wise?

Mr. Wise: If the Examiner please, I failed to point out, and my attention has been called to it, that Exhibit 13 sets forth certain figures for engineering. I am going to have to ask this witness a number of questions about it. What I am asking about, maybe a little prematurely, was the backup information to support these figures.

Mr. Hugh Smith: Mr. Examiner, might I make—

Presiding Examiner: I am going to rule that any requests like this be reserved at a later stage in Mr. Bonin's cross-examination. We keep getting into this problem of anticipating problems and requesting information that hasn't been tied in.

Mr. Sander?

2059

Mr. Sander: Mr. Counsel, identify the page he was talking about, the page you were referring to in the exhibit?

Mr. Wise: Page 18 of Exhibit 13.

Presiding Examiner: I would suggest we follow the ocedure of going ahead with as much of the examination Mr. Bonin as you feel you can conduct at this time, and ter you have concluded that phase of his examination, u then make any requests that you consider necessary r any additional information.

By Mr. Wise:

Q. Mr. Bonin, if either High Mountain Sheep or Lower nyon projects were actually to be built, did I under- nd you to say that you or some other engineering com- ny would have to enter into a contract with the applicant? I presume so. I don't believe they have sufficient engi- ering staff to design the project themselves.

Q. In other words, the project has not been designed yet? A. For construction?

Q. For construction. A. No.

Q. The design which you have submitted in support of application is merely a preliminary design for that rpose, is that correct? A. It is a preliminary design ovided for the purpose

Federal Power Commission license application, yes, sir.

Q. If the project were built, there would have to be a ular construction design project? A. Yes.

Q. Getting back to the point in connection with which Examiner ruled just a minute ago, would you turn to hibit 13, please. Will you show me where on that exhibit items are listed which covers the work which Ebasco rvices has done to date on High Mountain Sheep? A. ey are not in there.

Q. I beg your pardon? A. They are not in there.

Q. On the summary on page 18 you show an item under count No. 71 for engineering, $2,550,000.

Mr. Wise: Do you have a copy?
Presiding Examiner: No, I don't.
Thank you, I have one now.

By Mr. Wise:

Q. Would you please tell me what that covers? A. That covers the additional engineering required to design this project following issuance of a license by the Federal Power Commission.

Q. That would be the complete engineering figure for all the engineering work required in connection with the design and construction of the project?

A. No, for the design of the project.

Q. For the design only, not supervision of construction? A. No.

Q. Where does that appear in here? A. That is in some of the other accounts—field supervision, Account 65. Management concern is in—

Q. How much of that would include engineering and what sheet is that, please? A. That is on page 24 of Exhibit 13.

Q. I am sorry, but would you please repeat that? A. Account 65 is field supervision.

Q. That means field supervision by the engineering firm, is that correct? A. That's right.

Q. On Exhibit 12, which appears in this book here—
A. I don't have that.
Presiding Examiner: I don't have it either.

By Mr. Wise:

Q. The exhibit shows an item labled "Preliminary Expenses, $1,200,000."

Mr. Hugh Smith: I don't like to interrupt, Mr. Exam

iner, but that item was testified to by Mr. Robinson rather than this witness.

Presiding Examiner: Yes, I believe it was. However, go ahead with the question and let's see what happens.

2062

Mr. Hugh Smith: I am sorry, sir.

By Mr. Wise:

Q. Will you please tell me what is included in that item?

Mr. Hugh Smith: I object.

Mr. Wise: If the Examiner please, it is true the exhibit was testified to by Mr. Robinson.

Presiding Examiner: You don't have to argue the point any further. You may answer the question.

A. I do not know.

By Mr. Wise:

Q. I am confused and I admit this is due to my ignorance. I am not criticizing you nor counsel for the other side. I understood that Exhibit 13 was the estimate of the complete cost of the project. A. That is the cost to complete after the issuance of the license.

Q. There is nothing shown in Exhibit 13 or in any other exhibit which has been offered by the applicant which includes the preliminary work, is that true?

Presiding Examiner: Let him answer the question, if he knows, to the best of his knowledge.

A. I have no knowledge of the background of any of the exhibits prepared by anyone except myself. So I don't know what is in the other exhibits.

2063

Mr. Hugh Smith: Mr. Examiner, may I make a point. Mr. Robinson testified in his direct testimony, the $1,200,000

figure covers the cost of obtaining the license, which includes the engineering performed by Ebasco.

Presiding Examiner: Yes, I am aware of that. I just wanted to see where you were going, Mr. Wise. I must ask you to try and confine your examination of this witness to the area covered by his direct testimony, and in addition, not to argue about the inadequacy of the applicant's presentation.

Mr. Wise: I do think my next question is proper, Mr. Examiner. If it isn't, if I am not respecting your ruling, I feel certain this is the witness from which to get this information.

Presiding Examiner: Go ahead with your question.

By Mr. Wise:

Q. Will you tell me the total amount of engineering fee paid to your company by the application for all work done to date in connection with High Mountain Sheep? A. That is the figure I do not know at the moment. I do not know that figure.

Q. Will you be able to get that figure for me?

Mr. Wise: If the Examiner please, I think we now have reached a point where it is proper for me to request him to produce that information.

Presiding Examiner: You will have to address your

2064

request to Mr. Smith.

Mr. Smith?

Mr. Hugh Smith: I doubt the relevancy of this as to just exactly—I don't see how it becomes relevant. I am sure this figure can be assembled.

Presiding Examiner: I am a bit puzzled myself as to the relevancy of the figure. Could you enlighten me, Mr. Wise?

Mr. Wise: Yes, sir., Mr. Examiner. It seems to me it is highly relevant in connection with the point which I made

before. I don't want to be accused of arguing now either. But it goes back to the skimpiness, the preliminariness—if I may say—of the plans, of the work that has been done to date in support of this application. One way to show that is to show the amount of time and compensation that Ebasco has received for it.

Presiding Examiner: I will have to rule that the fee paid is irrelevant with regard to the alleged skimpiness or adequacy of the Ebasco design.

Mr. Wise: Don't you think, Mr. Examiner, it is relevant in so far as it then gets translated into time? I shall change my question to ask—

Presiding Examiner: I certainly didn't rule that you wern't entitled to a summarization of the time and effort spend by Ebasco on these designs. But that is a horse of another breed

2065

entirely. Why don't you proceed, Mr. Wise.

By Mr. Wise:

Q. Mr. Bonin, can you tell me the amount of time which has been spent by the employees of Ebasco on the High Mountain Sheep and Lower Canyon projects?

Mr. Hugh Smith: Mr. Examiner—

Presiding Examiner: If he knows.

A. I don't know the answer to that question. I think I said that before.

Presiding Examiner: I had understood you were going to get together with Mr. Smith at a later stage in this regard.

Mr. Wise: We have now reached that stage, your Honor, where we need that information.

Mr. Hugh Smith: Mr. Examiner, let me make this point. Possibly I am arguing the point you made yourself. Up to date we have now had—I haven't counted them—quite a number of speeches by counsel saying we have an in-

adequate, skimpy design and saying it has holes in it. If they think it has holes in it, it seems to me until counsel develops something on cross-examination that gives some kind of a foundation to that idea I might just as well say I think it is a ridiculous suggestion because I have been following this engineering very closely ever since we have started it. I know what we have demanded in terms of quality out of this company.

2066

I want Mr. Wise to get into this thing so that we will stop having speeches made by counsel, so that we will get to the question of just what engineering Ebasco has done under Mr. Bonin's supervision.

If at such time Mr. Wise develops something on cross-examination and indicates we should bring all this material in, we will bring it in. But until some kind of a foundation is laid other than just statements of counsel, it seems to me we waste time, sir.

Presiding Examiner: I will take this request up at the close of this witness' cross-examination. I think that was my prior approach, and I think I will stick to it.

By Mr. Wise:

Q. Mr. Bonin, can you tell me how many engineers were working on this project along with you? A. No. I can't.

Q. But you were supervising them, I believe you said, directly? A. Yes.

Q. But you don't know how many there were? A. I would not know the total number of engineers, designers.

Q. Do you know how many were out in the field? A. I don't know the exact number. The exact number varied, of course.

2067

Q. What is the largest number you had at any time? A. I don't know.

Q. How much time did you say you had spent on it personally? A. I don't think I said.

Q. I am sorry. I had thought you did. Would you mind telling me how much time you have spent on it personally? A. I think that that has varied in the period from 1957 to date from as little as a day a month to as much as nearly half a month. What the total aggregate time is, I do not know at this moment.

Q. Would you tell us very roughly—I don't expect you to know with any fine degree of precision—as to how much of the time that you have spent on the project prior to the time you were instructed to file an application for a license for High Mountain Sheep? A. I am afraid I don't know the answer to that.

Q. You can't give us any rough idea? A. No. I have no idea whatsoever.

Q. When were you instructed to commence work on the filing of an application, the preparation of an application? A. The actual preparation of the application itself was, of the present application, was instituted not too long ago, just shortly before it was filed.

Q. And when was that? A. I don't recall the date. But the actual preparation of the application was started, I would say, two months before that date.

Q. When were you instructed to make the study with respect to Lower Canyon? A. We had been studying Lower Canyon, I would say from the time we first got into alternate plans of development for this section of the river.

Q. When was that? A. I think we first talked about that in 1957. I would have to check my dates.

Q. Had you completed the studies which you present in Exhibit 16 prior to the time the application was filed in this case? A. I think so, yes. I think so. I am not certain.

Q. You are not certain? A. There may have been some final modifications to drawings, but I am not sure of that.

Mr. Hugh Smith: Mr. Examiner, I think there has been some confusion with the witness. I wonder if Mr. Wise would like to identify from PNCP Exhibit 41 just what dates he is talking about when he says "the application was filed."

The Witness: There have been a number of applications. That is the reason I am a little confused.

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Presiding Examiner: I assume when he says "the application" without any other qualifications, he is talking about this pending application. If he isn't, then I am under a misunderstanding.

Mr. Wise: That is correct.

By Mr. Wise:

Q. Did I understand you to say that you had compeleted the studies during the two months prior to filing the application? A. No. No. I said the date—you asked me when we were instructed to work toward the preparation of an application. I said it must have been approximately two months prior to the date the application was filed. That is about the time it would take to prepare the document—at least the portions of it that Ebasco does.

2070

Q. It was during that time that you prepared the design which appears in the exhibits here. Is that correct. A. No, that is not necessarily correct.

Q. What is correct? A. This exhibit was put in, I believe in September—September 20 or some date like that. Work was done on these designs right up to that point.

Q. When was the work started on the designs which ap-

pear in Exhibit 16—that is, those other than High Mountain Sheep? A. Oh, I guess back as far as May 1957.

Q. Actual design, preliminary design, the type of design you use for application? A. Yes. Studies were made of alternate designs.

Q. When were they finished? A. Just prior to September 2—if that is the date the testimony was filed.

Q. Who gave you the instructions, Mr. Bonin, as to which site you were to make the studies with respect to?

Mr. Hugh Smith: Mr. Examiner, I am not sure the question of who gave him—the individual—is relevant. It may be relevant to determine whether or not he was instructed by the company, but the individual who may or may not have transmitted such instructions would not be relevant.

Furthermore, I submit that Mr. Wise hasn't established

hat any such instructions were given yet.

Presiding Examiner: Would you rephrase your question, Ir. Wise?

By Mr. Wise:

Q. Were you instructed by anyone to prepare these plans or Lower Canyon and the other projects appearing in xhibit 16? A. My instructions were to examine a reach f the river, I believe it is approximately Grand Ronde up the Hells Canyon trailwater on the Snake, and a reasonbly comparable reach of the Salmon.

Q. When were you given those instructions? A. I believe at was approximately May 1957.

Q. Do I understand you to say that no one instructed ou to prepare a design in enough detail to be presented re with respect to the Lower Canyon site? A. I didn't y that.

Q. Did anyone give you such instructions? A. No. They tructed me to investigate this reach of the river, and to

determine the most feasible and the best project in that reach of the river.

Q. When was that? A. In May of 1957.

Q. Then what happened chronologically after that? A. An awful lot happened chronologically after that.

2072

With respect to Mountain Sheep?

Q. Let's take Mountain Sheep first. A. With respect to Mountain Sheep, we investigated several alternate locations of the dam within a short distance up and downstream.

Q. Pardon me. Did anyone in the applicant, any official of the applicant, suggest that to you as a site, or was that entirely the determination of Ebasco? A. High Mountain Sheep?

Q. High Mountain Sheep. A. The actual choice of the precise location I believe was entirely Ebasco's. The choice of the general location, so-called High Mountain Sheep between the mouth of the Imnaha and the Mouth of the Salmon, was indicated to be the major project of one of the alternate plans of development.

Q. Indicated by whom? A. By the applicant, in May 1957.

Q. What indication was given by the applicant with respect to the Lower Canyon Project? A. Again they indicated that that reach of the river should be studied for a method of development. There were a number of ways of developing that reach of the river.

Q. Was any indication given to you with respect to a general site or a general area for a site other than the reach of the river?

2073

A. I don't know whether the specific instructions included this named Lower Canyon as one of the possible alternates

or not. That is not the only way of developing that reach of the river, of course.

Q. That is what I am trying to find out—what you were told by the applicant. A. I was told to look into the feasibility and the economics of alternate sites, alternate methods, of developing that reach of the river.

Q. I understood you to say there was an indication given to you by the applicant that the site in the general area where your proposed High Mountain Sheep is now located was indicated by the company. A. That's right.

Q. Was there a similar indication given with respect to Lower Canyon? A. I said I did not think there was but I don't know. They may have mentioned Lower Canyon as one of the alternate methods of developing the Salmon River branch of the Snake, but I am not sure of that.

Q. Were all of the contacts between the applicant and Ebasco carried on on behalf of Ebasco by you? A. I believe that they may have written certain routine letters to my assistants.

Q. It was through your office?

2074

A. I am sure that they wrote to Mr. Stuber, the chief civil engineer.

KQ. You don't have a recollection as to what may have been said on this. Is that correct? A. No instructions were given Mr. Stuber, no. These were routine matters that were handled through Mr. Stuber.

Q. You have no recollection of any indication having been given to you by the applicant with respect to the location of Lower Canyon? A. No. I do not recollect whether or not in their instructions in May 1957 they so indicated.

Q. They may have? A. They may have.

Presiding Examiner: Before we recess for lunch, I would like to ask a question of Mr. Smith, if I may.

Am I clear in understanding that Mr. Bonin will be the

sole witness to testify with regard to the engineering services rendered by Ebasco for the applicant?

Mr. Hugh Smith: That is correct, sir.

Presiding Examiner: If that is so—and I am not making any direction—

Mr. Hugh Smith: Excuse me, I am sorry. There is one exception that Mr. Bonin mentioned that I had completely forgotten about, and that is that it is possible that some consulting service was given to Mr. Blair in connection with

2075

transmission. In that case Mr. Blair will have to testify to it, although we don't have an Ebasco witness.

Presiding Examiner: In respect to transmission facilities?

Mr. Hugh Smith: That is correct, sir.

Presiding Examiner: If the first part of your statement is so—and of course I assume it to be so—I do want to indicate that I feel that this record should include testimony or material with regard to the amount of the work done by Ebasco.

In other words, I am indicating to you that my present thinking is that this material ought to be made available before Mr. Bonin is excused without reference to any time deadlines, and I would appreciate your working that matter out with Mr. Wise.

Mr. Hugh Smith: I assume, sir, the same ruling will of course apply to the Harza Engineering Company?

Presiding Examiner: All of my rulings apply across the board.

The Witness: I might point out I think you have all very conveniently forgotten Mr. Tonetti.

Presiding Examiner: Frankly, my only concern is that this came into the record at some stage. The way it comes in, of course, is up to counsel. I am merely indicating before we recess for lunch and without reference to any time

schedule here that I do feel that the request is a legitimate one, that the amount of work done by Ebasco at some stage be in this record.

Mr. Hugh Smith: I would suggest that Mr. Wise and I will confer to define the nature of his request.

Presiding Examiner: We will resume at two o'clock.

(Whereupon, at 12:30 o'clock p.m., the hearing was adjourned, to reconvene at 2 o'clock p.m., the same day.)

AFTERNOON SESSION

2:00 p.m.

Presiding Examiner: Shall we come to order, please.

Are there any preliminary matters before Mr. Wise proceeds with Mr. Bonin's examination?

Mr. Smith.

Mr. Hugh Smith: Two semi-progress reports, Mr. Examiner, because we have told you we would inform you on both matters.

As to the examination of some of the quantity take-off data, the man in charge went back to get his data. He has not arrived before the commencement of the hearing unfortunately. Mrs. Cooper and I have agreed that when he arrives she and some of her engineers will retire to another room and will conduct this examination while the hearing proceeds.

With regard to Mr. Wise's request as to data concerning the amount of time involved in this by Ebasco Services, Mr. Wise advises me he would like to have a discussion on that tomorrow morning, rather than today.

Presiding Examiner: Very well. We will discuss that latter matter at the opening of the hearing tomorrow morning.

Mr. Wise: If the Examiner please, it was my thought I could be a little more specific if I could consult with our engineers to find in which form it would serve our purposes to minimize the burden.

Presiding Examiner: Fine. We can take that up as a preliminary matter in the morning.

Sheets 1-29 of Exhibit L of PNPC Application for License for Middle Snake River Hydroelectric Project, Project No. 2243

Filed March 31, 1958

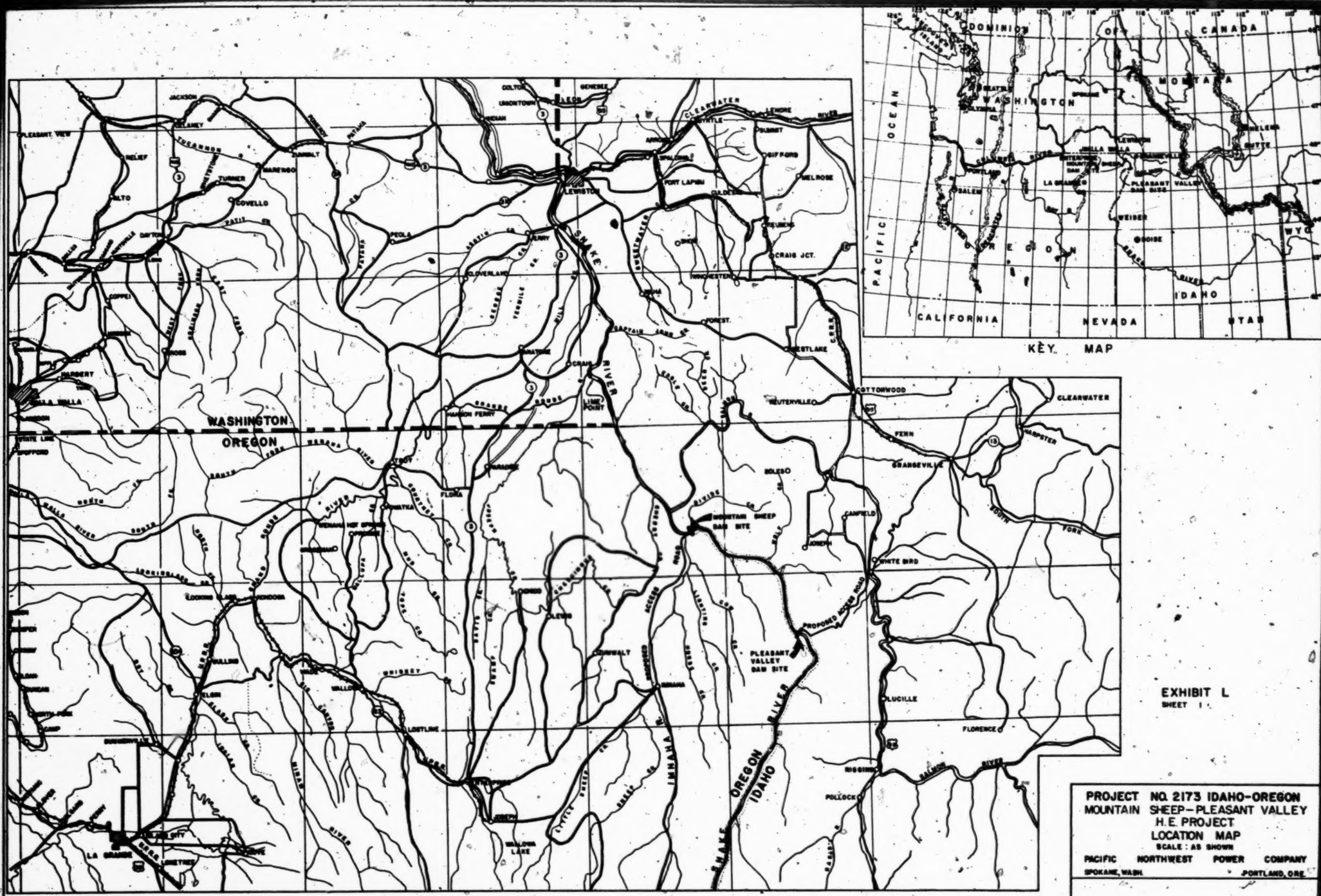
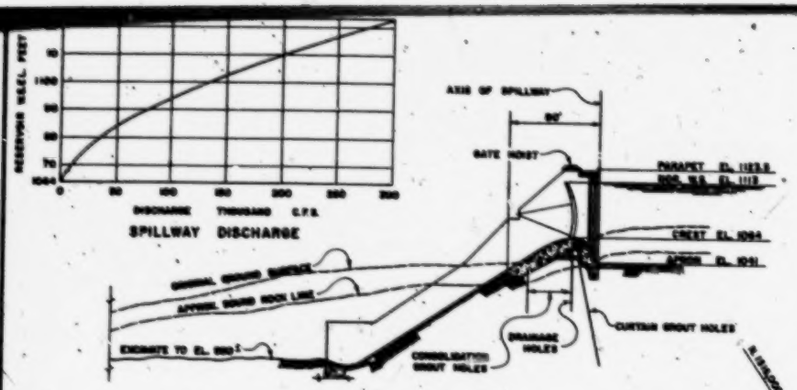


EXHIBIT L
SHEET 1

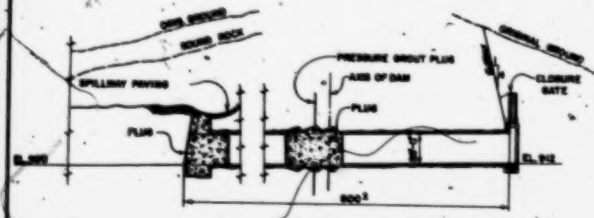
PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP-PLEASANT VALLEY
H.E. PROJECT
LOCATION MAP
SCALE: AS SHOWN
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1958

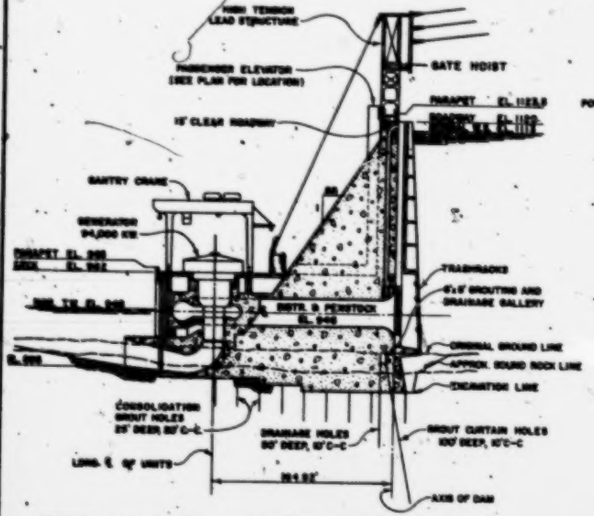
10-A-200



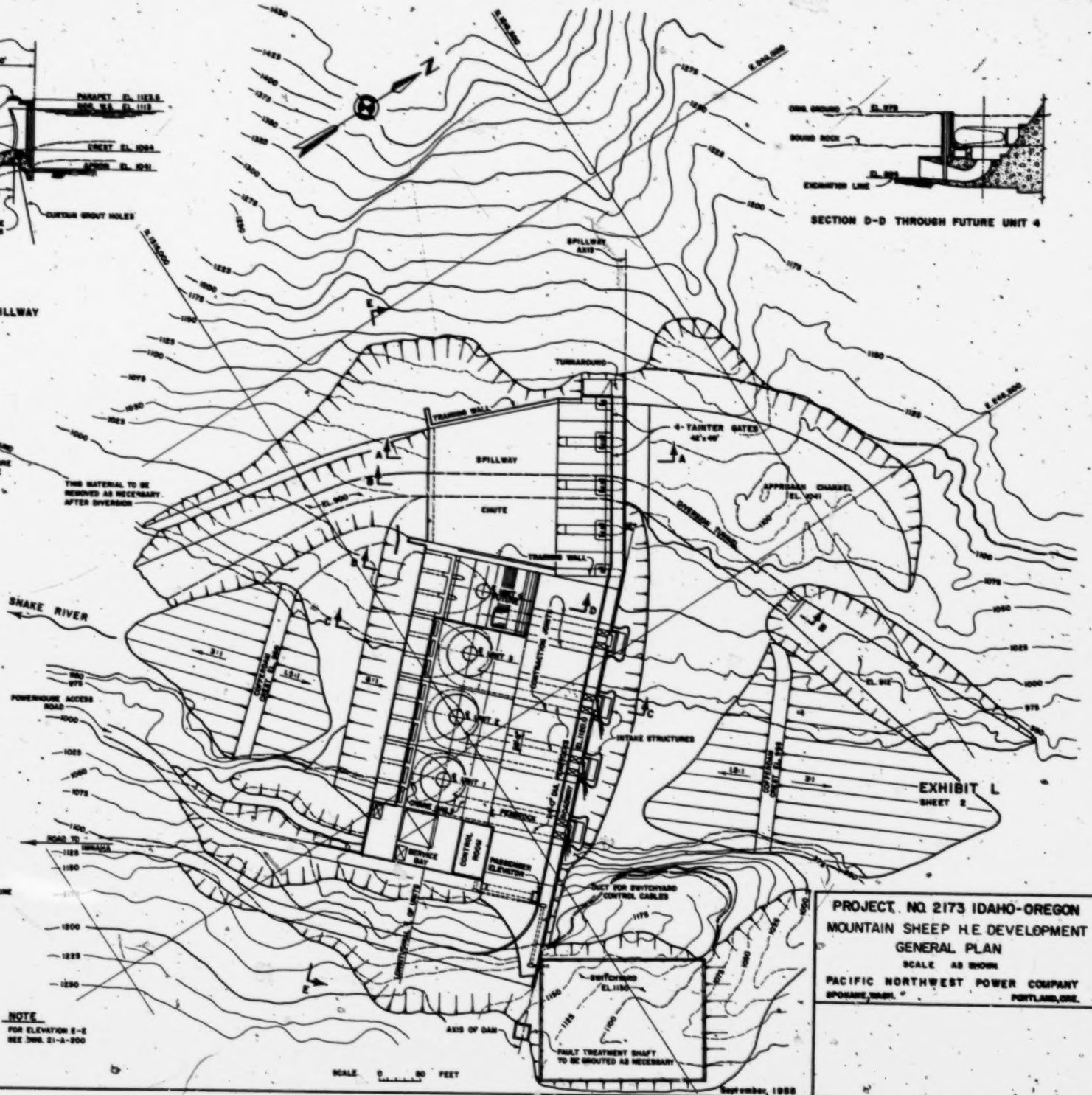
SECTION A-A THROUGH SPILLWAY



SECTION B-B THROUGH DIVERSION TUNNEL



SECTION C-C THROUGH DAM AND POWERHOUSE UNITS 1, 2 & 3



NOTE
FOR ELEVATION E-E SEE DWG. 21-A-200

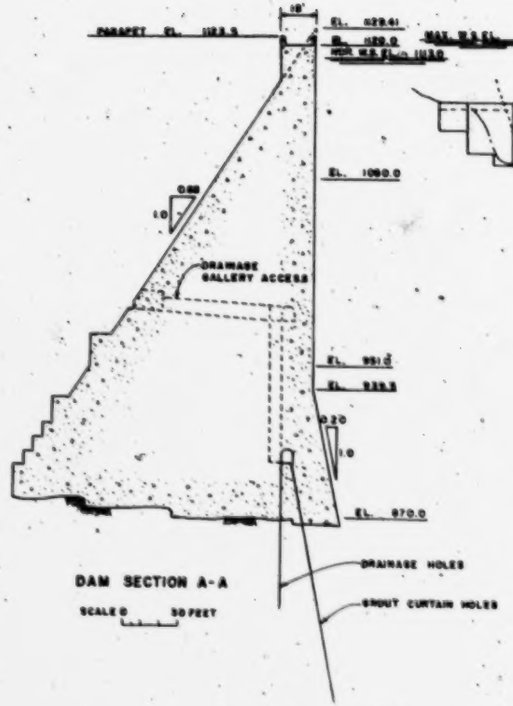
SECTION D-D THROUGH FUTURE UNIT 4

EXHIBIT L
SHEET 2

PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
GENERAL PLAN
SCALE AS SHOWN
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

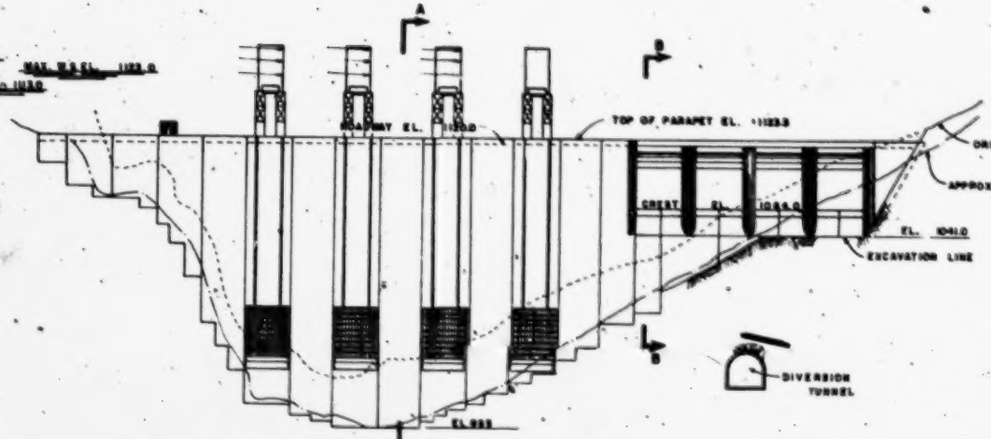
September, 1958

10-A-251



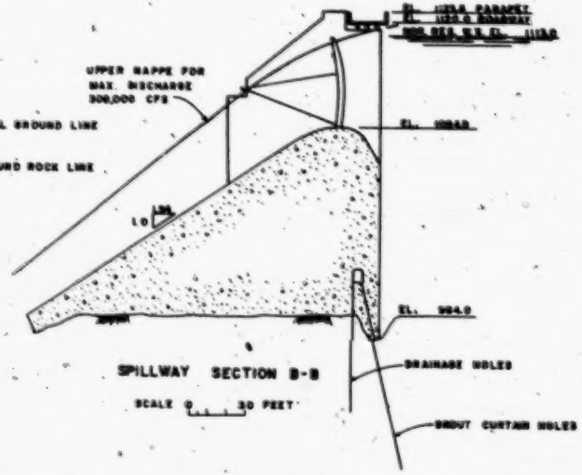
DAM SECTION A-A

SCALE 0 50 FEET



UPSTREAM ELEVATION DEVELOPED

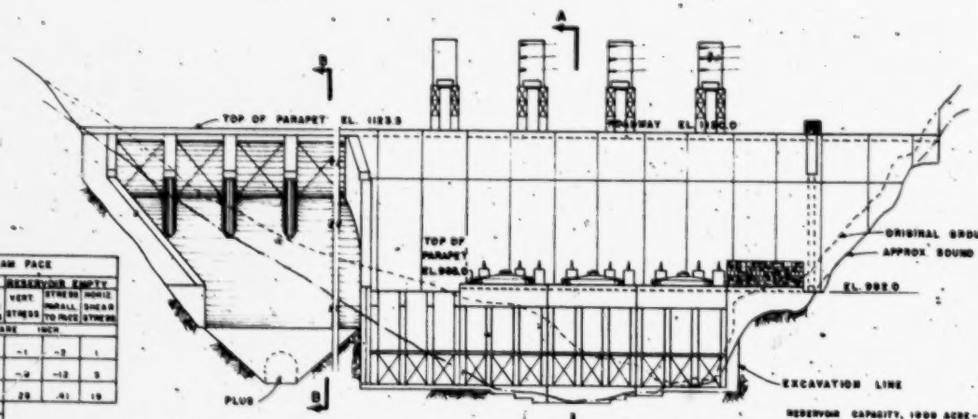
SCALE 0 50 FEET



SPILLWAY SECTION B-B

SCALE 0 50 FEET

SPILLWAY STABILITY ANALYSIS LOADING DIAGRAMS



DOWNSTREAM ELEVATION E-E

(FOR LOCATION SEE DWG. 10-A-251)

SCALE 0 50 FEET

GRAVITY DAM STRESSES

ELEV.	UPSTREAM FACE						NORIZ SECTION			DOWNSTREAM FACE					
	RESERVOIR EMPTY			NORMAL RES. W.S. EL. 1113						RESERVOIR EMPTY			NORMAL RES. W.S. EL. 1113		
	VERT. STRESS	STRESS PARALL TO FACE	HORIZ. SHEAR STRESS	WATER PRESS.	VERT. STRESS	STRESS PARALL TO FACE	SLIDING FACTOR	SHEAR FRICT. FACTOR	MAXIMUM SHEAR STRESS	WATER PRESS.	VERT. STRESS	STRESS PARALL TO FACE	WATER PRESS.	VERT. STRESS	HORIZ. SHEAR STRESS
	POUNDS PER SQUARE INCH			POUNDS PER SQUARE INCH						POUNDS PER SQUARE INCH			POUNDS PER SQUARE INCH		
1050	90	90	0	37	38	38	0	0.44	22.0	25	0	34	37	36	-1	-2	1
921	154	109	0	70	25	88	0	0.68	10.0	93	0	121	170	82	-9	-12	9
870	212	220	62	103	-3	-10	22	0.90	- 7.0	88	30	181	233	88	28	-41	19
NORMAL RESERVOIR W.S. EL. 1113 EARTHQUAKE ACCELERATION 0.10G UPSTREAM															
870				114	-41	-68	36	1.1	0.8	120	30	219	308	120			
MAXIMUM RESERVOIR W.S. EL. 1123 NO EARTHQUAKE LOAD															
870				110	-28	-31	27	0.93	0.0	109	30	194	257	109			

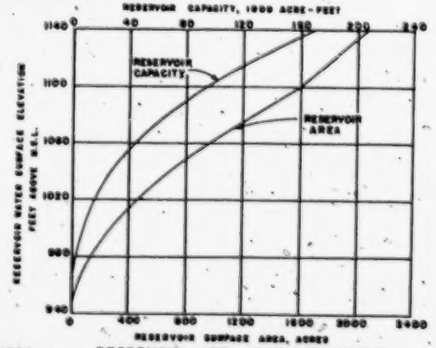
NOTE: UPLIFT DUE TO FULL HEADWATER PRESSURE AT UPSTREAM FACE, TO ELEVATION 940 TAILWATER AT DOWNSTREAM FACE, AND TAILWATER PRESSURE PLUS ONE-THIRD THE DIFFERENTIAL BETWEEN HEADWATER AND TAILWATER AT THE LINE OF DRAINS, ASSUMED ACTING OVER ENTIRE BASE AREA.

DAM STABILITY ANALYSIS LOADING DIAGRAMS

SPILLWAY DAM STRESSES

ELEV.	DOWNSTREAM FACE			NORIZ. SECTION			UPSTREAM FACE		
	NORMAL RESERVOIR W.S. EL. 1113								
	WATER PRESS.	VERT. STRESS	STRESS PARALL. TO FACE STRESS	SLIDING FACTOR	SHEAR FRICT. FACTOR	MAXIMUM SHEAR STRESS	WATER PRESS.	VERT. STRESS	HORIZ. SHEAR STRESS
	NO EARTHQUAKE LOADING POUNDS PER SQUARE INCH								
984	0	43	102	88	0.48	1.0	88	88	71	0
	EARTHQUAKE ACCELERATION 0.10 UPSTREAM								
984	0	96	193	96	0.62	1.0	88	88	93	0

EXHIBIT L
SHEET 3

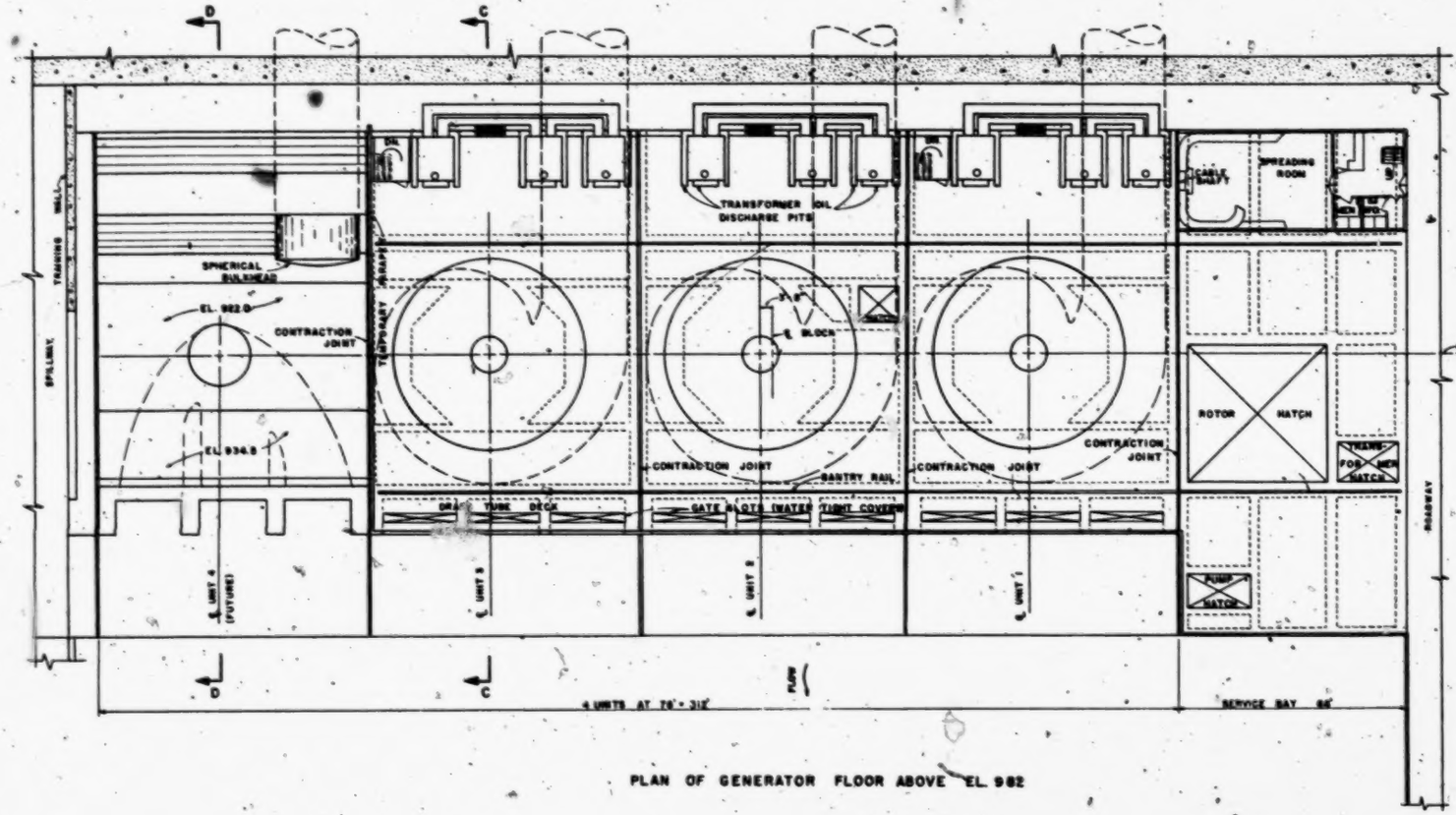


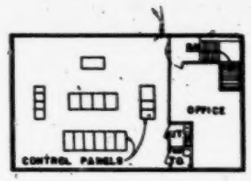
RESERVOIR AREA CAPACITY CURVE

September, 1955

PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
DAM - ELEVATIONS
SCALE: AS SHOWN
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

21-A-200

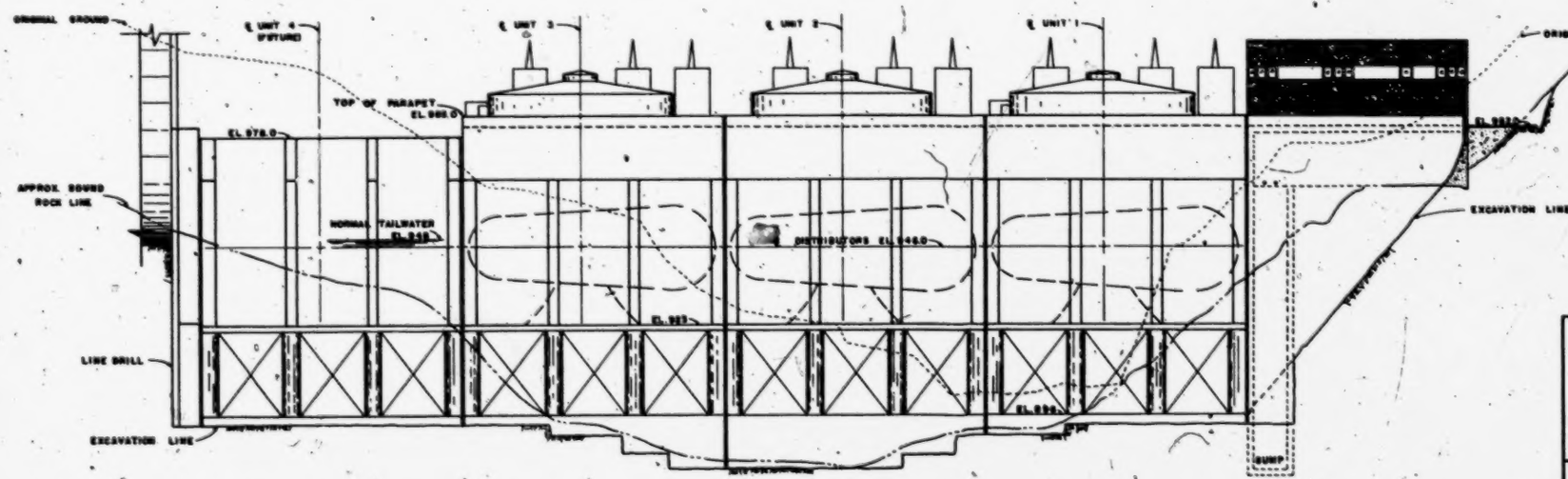




CONTROL ROOM FLOOR EL. 993

NOTE:
FOR SECTIONS C-C AND D-D SEE DWG 41-A-201

PLAN OF GENERATOR FLOOR ABOVE EL. 982



DOWNSTREAM ELEVATION

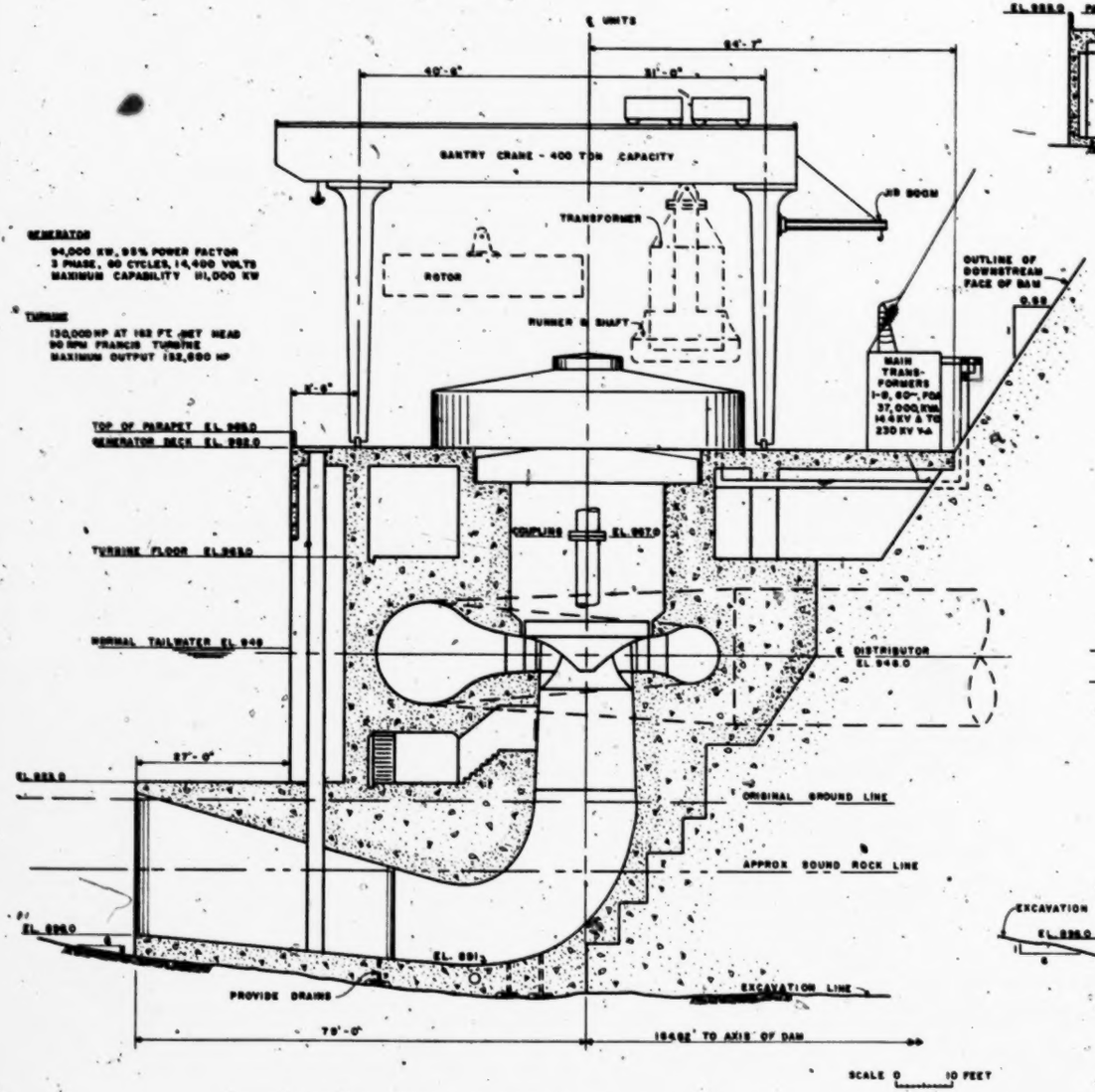
SCALE 0 16 FEET

EXHIBIT L
SHEET 4

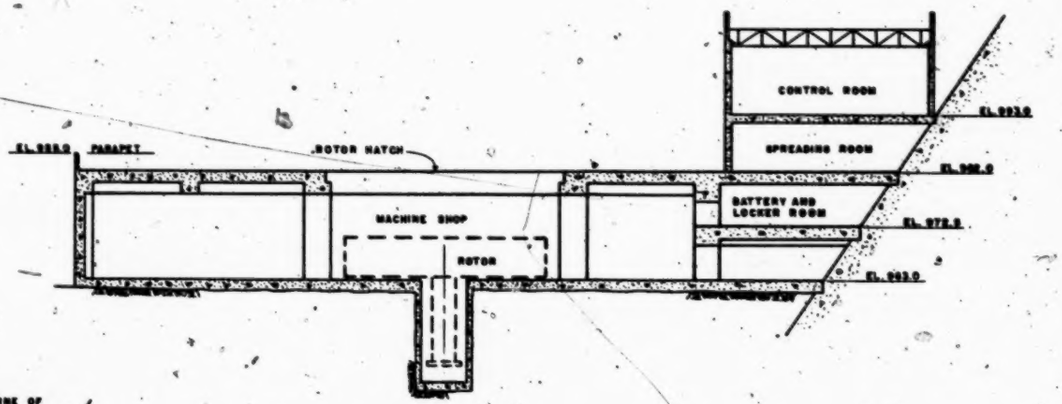
PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
POWERHOUSE - GENERAL PLAN
SCALE AS SHOWN
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1958

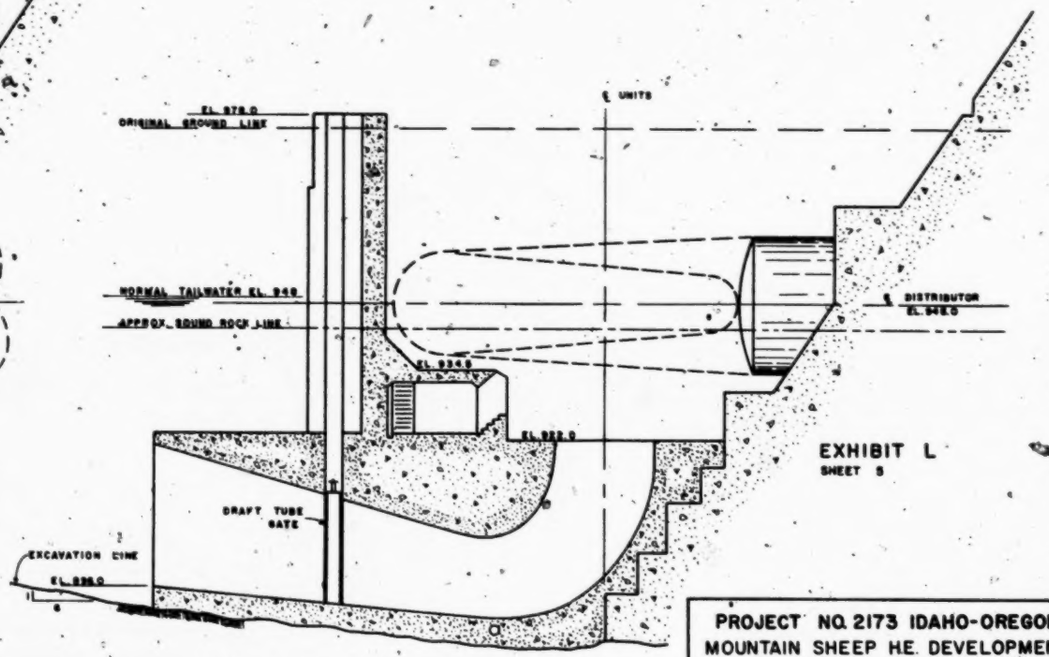
41-A-200



TYPICAL CROSS SECTION C-C THROUGH ℄ UNITS 1, 2, 3



TRANSVERSE SECTION THROUGH SERVICE BAY



SECTION D-D THROUGH FUTURE UNIT - NO. 4

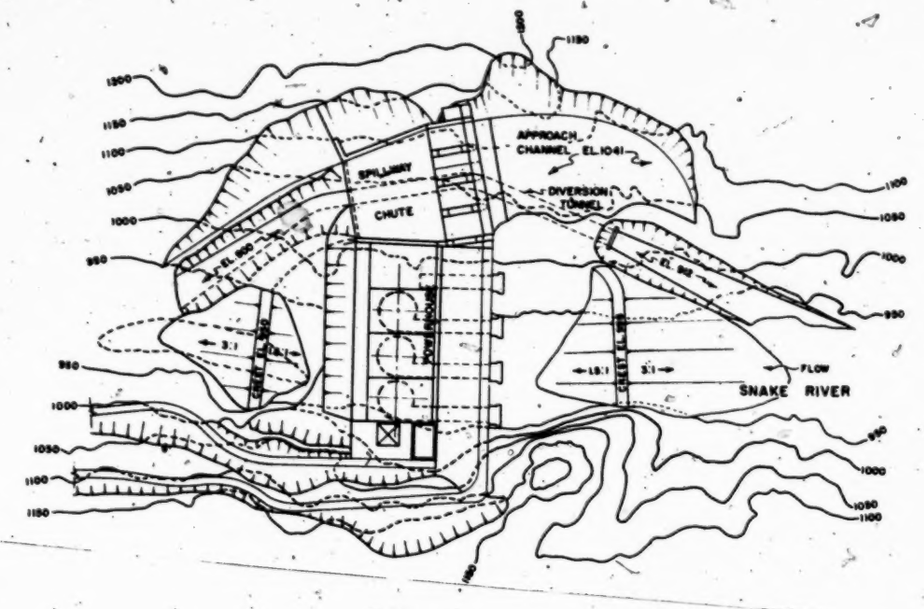
NOTE:
FOR LOCATION OF SECTIONS C-C AND D-D SEE DWG. 41-A-200.

EXHIBIT L
SHEET 8

PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
POWERHOUSE - TRANSVERSE SECTIONS
SCALE: 1" = 10'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1955

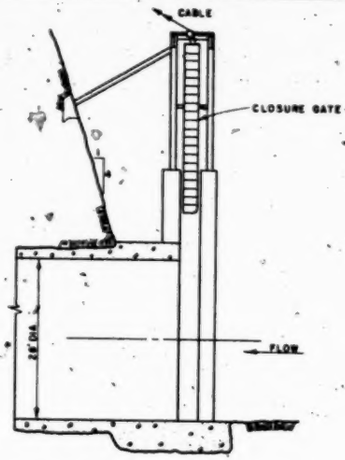
41-A-201



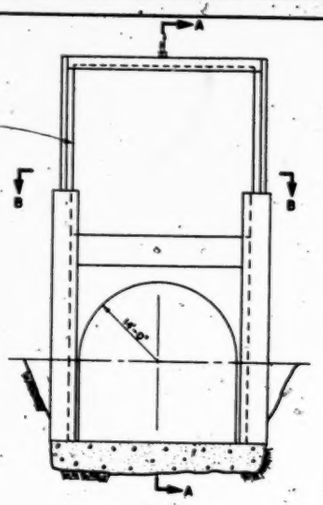
PLAN

SCALE 0 100 FEET

(SWITCHYARD NOT SHOWN)



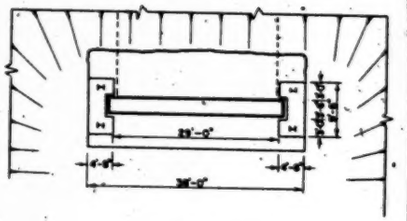
SECTION A-A



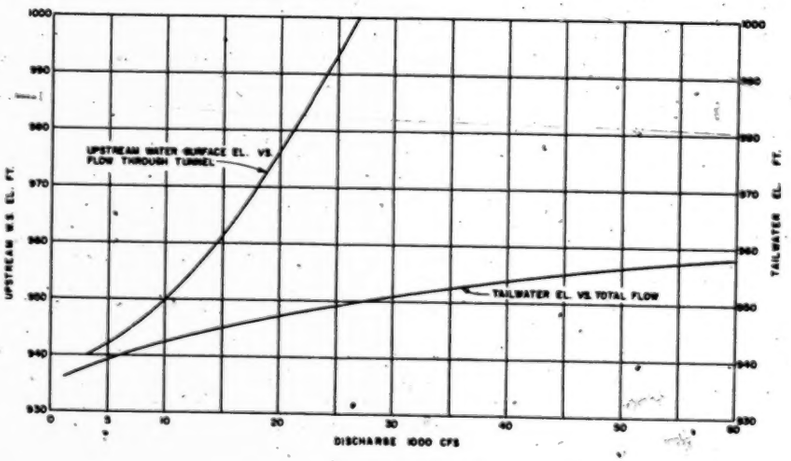
ELEVATION

INLET PORTAL

SCALE 0 10 FEET



SECTION B-B

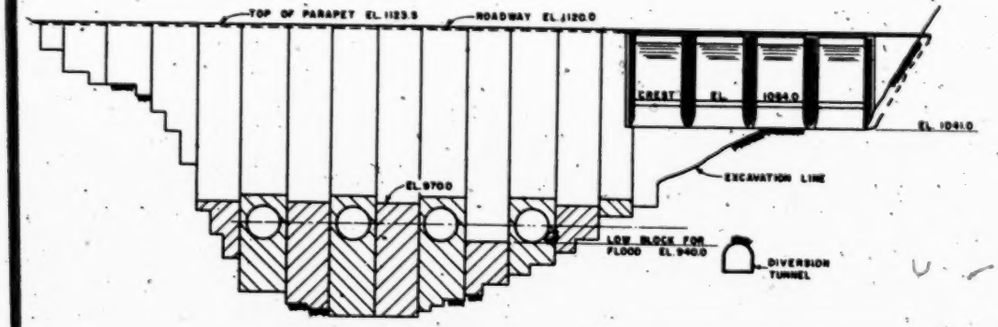

UPSTREAM WATER SURFACE EL. VS. FLOW THROUGH TUNNEL
TAILWATER EL. VS. TOTAL FLOW
UPSTREAM W.S. EL. FT.
TAILWATER EL. FT.
DISCHARGE 1000 CFS

RATING CURVE FOR DIVERSION

WATER SURFACE EL. VS. DISCHARGE

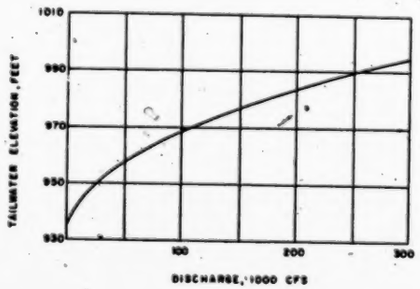
EXHIBIT L

SHEET 6

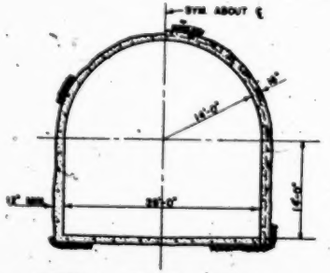


UPSTREAM ELEVATION

SCALE 0 50 FEET



TAILWATER RATING CURVE



TYPICAL TUNNEL SECTION

UNSUPPORTED SECTION SUPPORTED SECTION

SCALE 0 8 FEET

PROJECT NO. 2173 IDAHO-OREGON

MOUNTAIN SHEEP H.E. DEVELOPMENT

DIVERSION FACILITIES

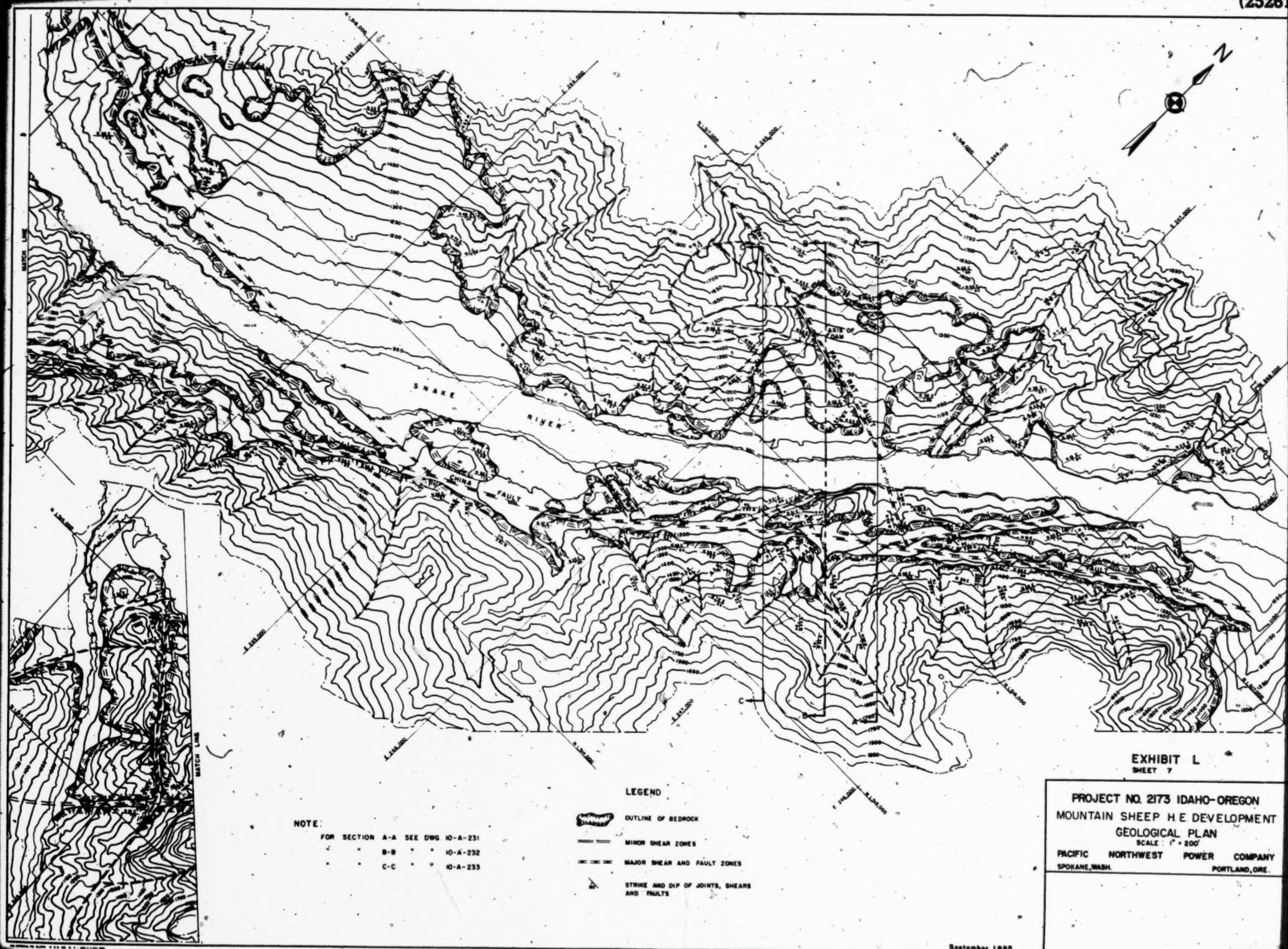
SCALE AS SHOWN

PACIFIC NORTHWEST POWER COMPANY

SPOKANE, WASH. PORTLAND, ORE.

September, 1955

10-A-252



LEGEND

OUTLINE OF BEDROCK

MINOR SHEAR ZONES

MAJOR SHEAR AND FAULT ZONES

STRIKE AND DIP OF JOINTS, SHEARS AND FAULTS

NOTE:

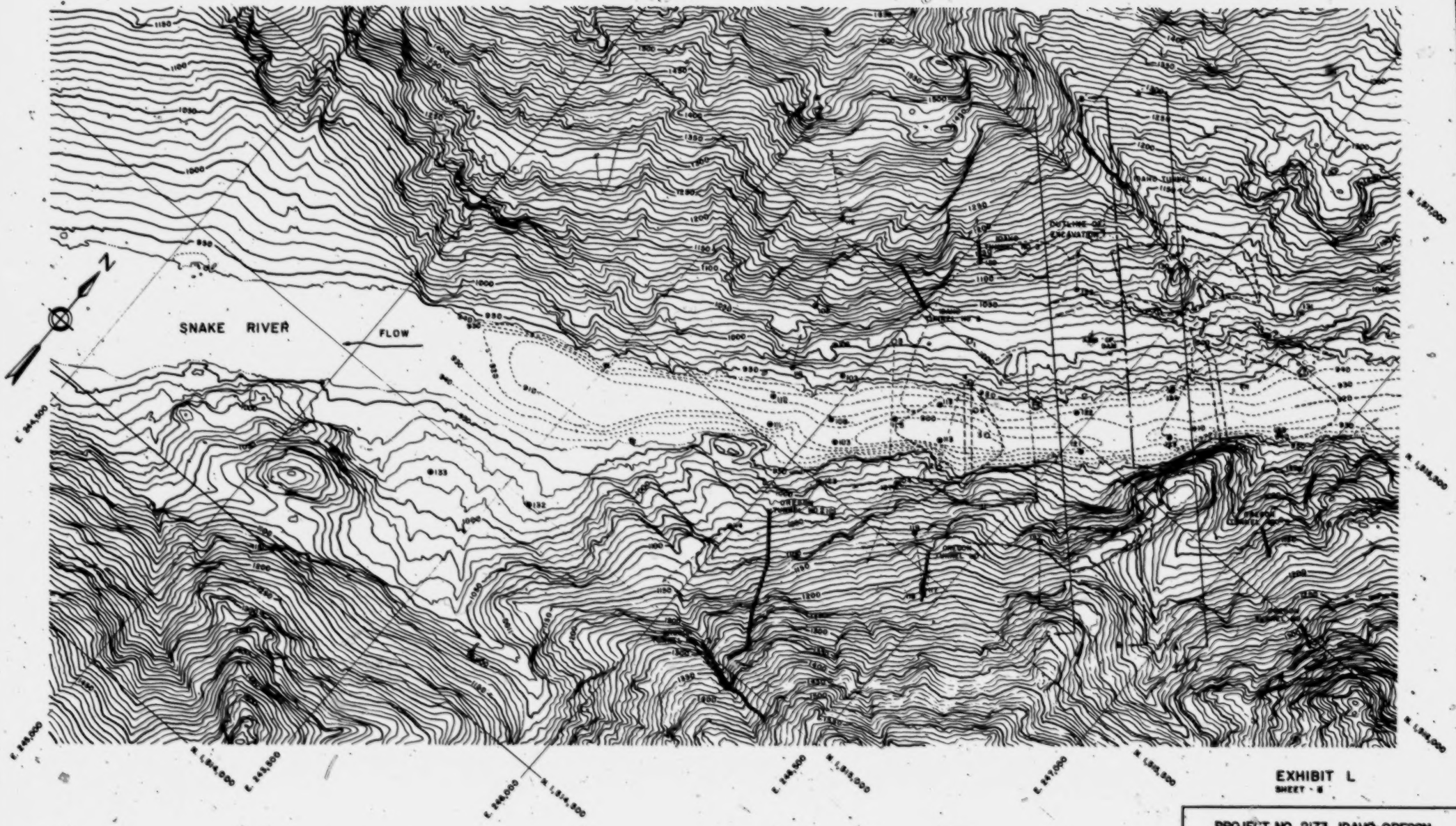
FOR SECTION A-A SEE DWG 10-A-231
" " B-B " " 10-A-232
" " C-C " " 10-A-233

EXHIBIT L
SHEET 7

PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
GEOLOGICAL PLAN
SCALE: 1" = 200'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1955

10-A-230



NOTE:

FOR SECTION A-A SEE DWG. 10-A-231
" " B-B " " 10-A-232
" " C-C " " 10-A-233

FOR LOGS OF DRILL HOLES SEE DWG. 10-A-210 THRU 10-A-227

FOR DETAILED TUNNEL LOGS SEE DWG. 10-A-230

SCALE 0 100 200 FEET

LEGEND

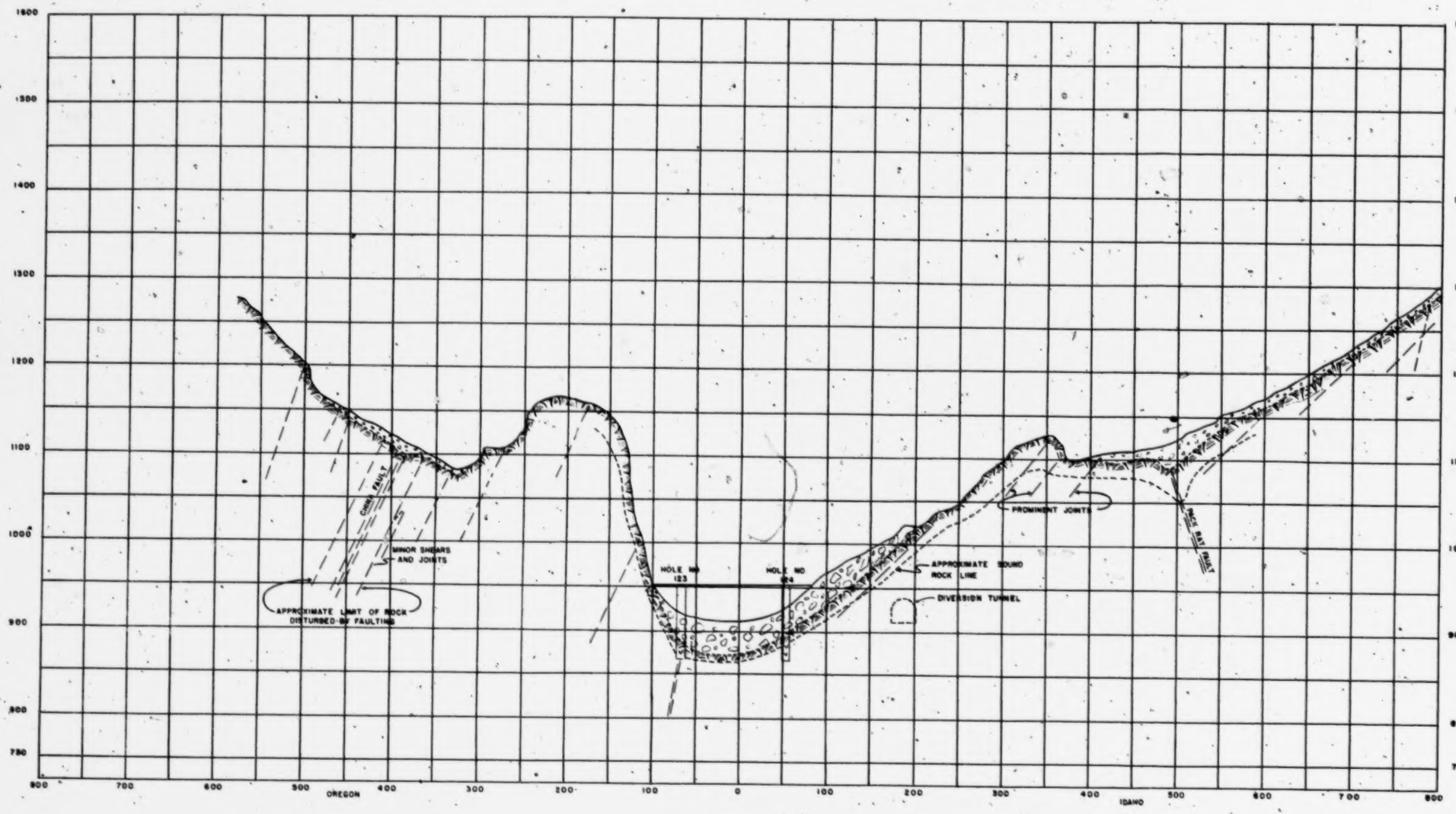
- ○ DRILL HOLES USBR
- ● DRILL HOLES PACIFIC NORTHWEST POWER COMPANY
- TUNNELS
- CENTER LINE OF SECTIONS
- HORIZONTAL PROJECTION OF ANGLE HOLES

September, 1955

EXHIBIT L
SHEET - 8

PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
FOUNDATION EXPLORATION PLAN
SCALE: 1" = 100'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

10-A-229



GEOLOGIC SECTION A-A'

EXHIBIT L
SHEET 9

NOTE:

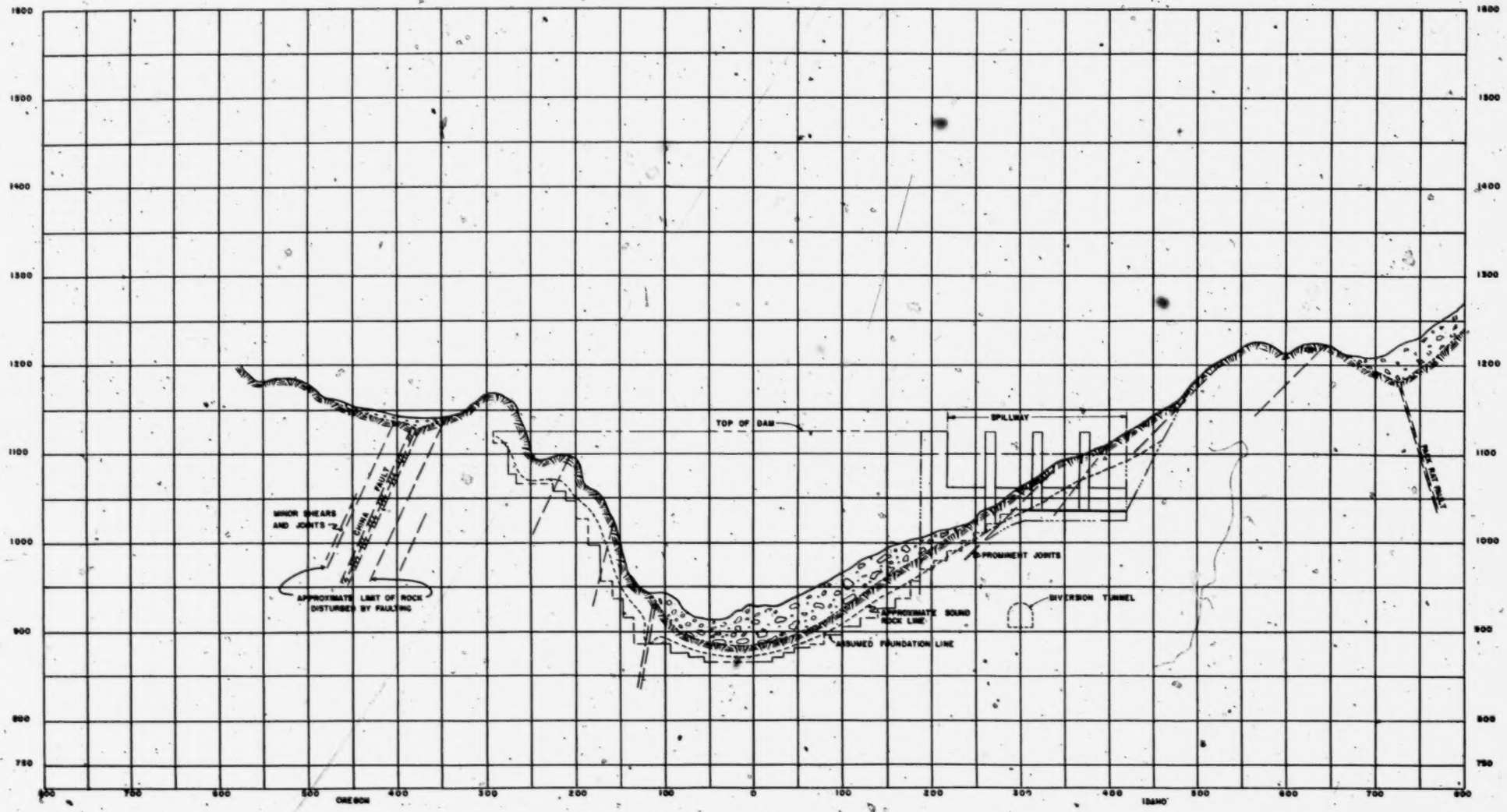
FOR LOCATION OF SECTION SEE DWG 10-A-229

LEGEND

- OVERBURDEN
- BEDROCK
- GRANITE
- BASALT
- DIORITE
- PROMINENT JOINTS
- MINOR SHEAR ZONES
- MAJOR SHEAR AND FAULT ZONES

PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
GEOLOGICAL SECTION
SCALE: 1" = 50'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1955



GEOLOGIC SECTION B-B'

EXHIBIT L
SHEET 10

NOTE:
FOR LOCATION OF SECTION SEE DWG. 10-A-229

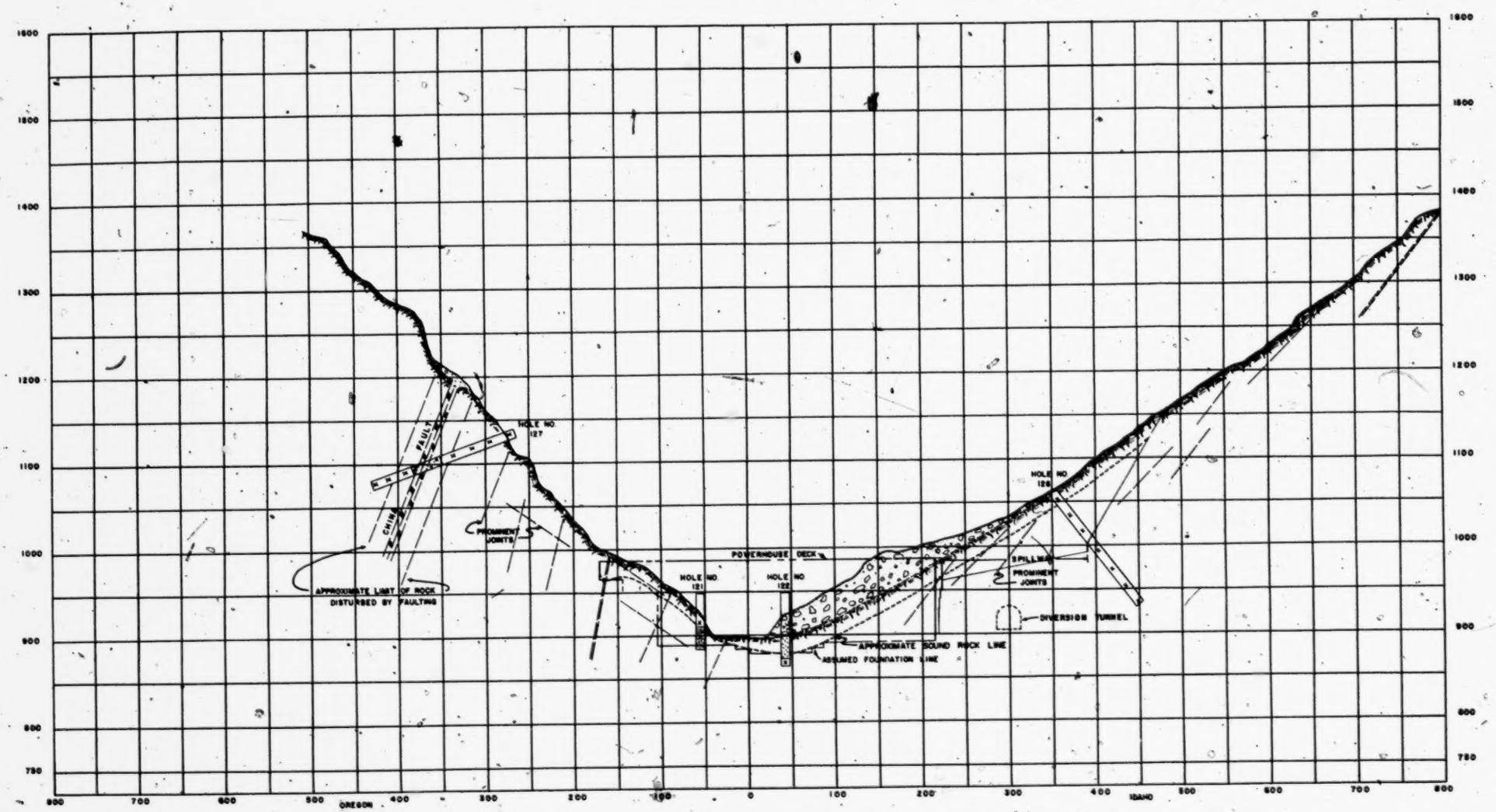
LEGEND

- OVERBURDEN
- BEDROCK
- GRANITE
- BASALT
- DIORITE
- PROMINENT JOINTS
- MINOR SHEAR ZONES
- MAJOR SHEAR AND FAULT ZONES

PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
GEOLOGICAL SECTION
SCALE: 1" = 50'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1958

10-A-232



GEOLOGIC SECTION C-C'

EXHIBIT L
SHEET 11

NOTE:
FOR LOCATION OF SECTION SEE DWG. 10-A-229

LEGEND

- OVERBURDEN
- BEDROCK
- GRANITE
- BASALT
- DIORITE
- PROMINENT JOINTS
- MINOR SHEAR ZONES
- MAJOR SHEAR AND FAULT ZONES

September, 1955

PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
GEOLOGICAL SECTION
SCALE: 1" = 50'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

10-A-233

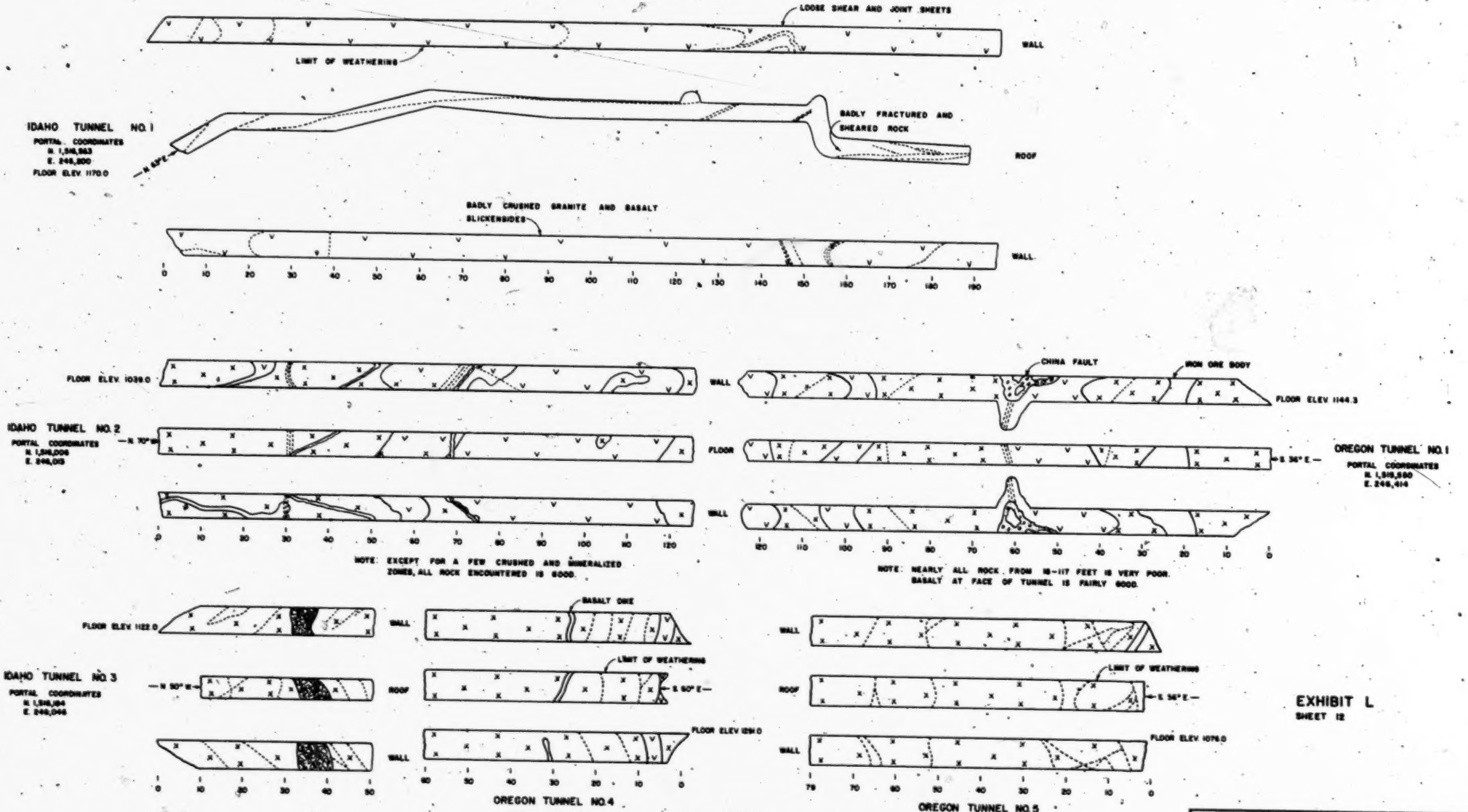
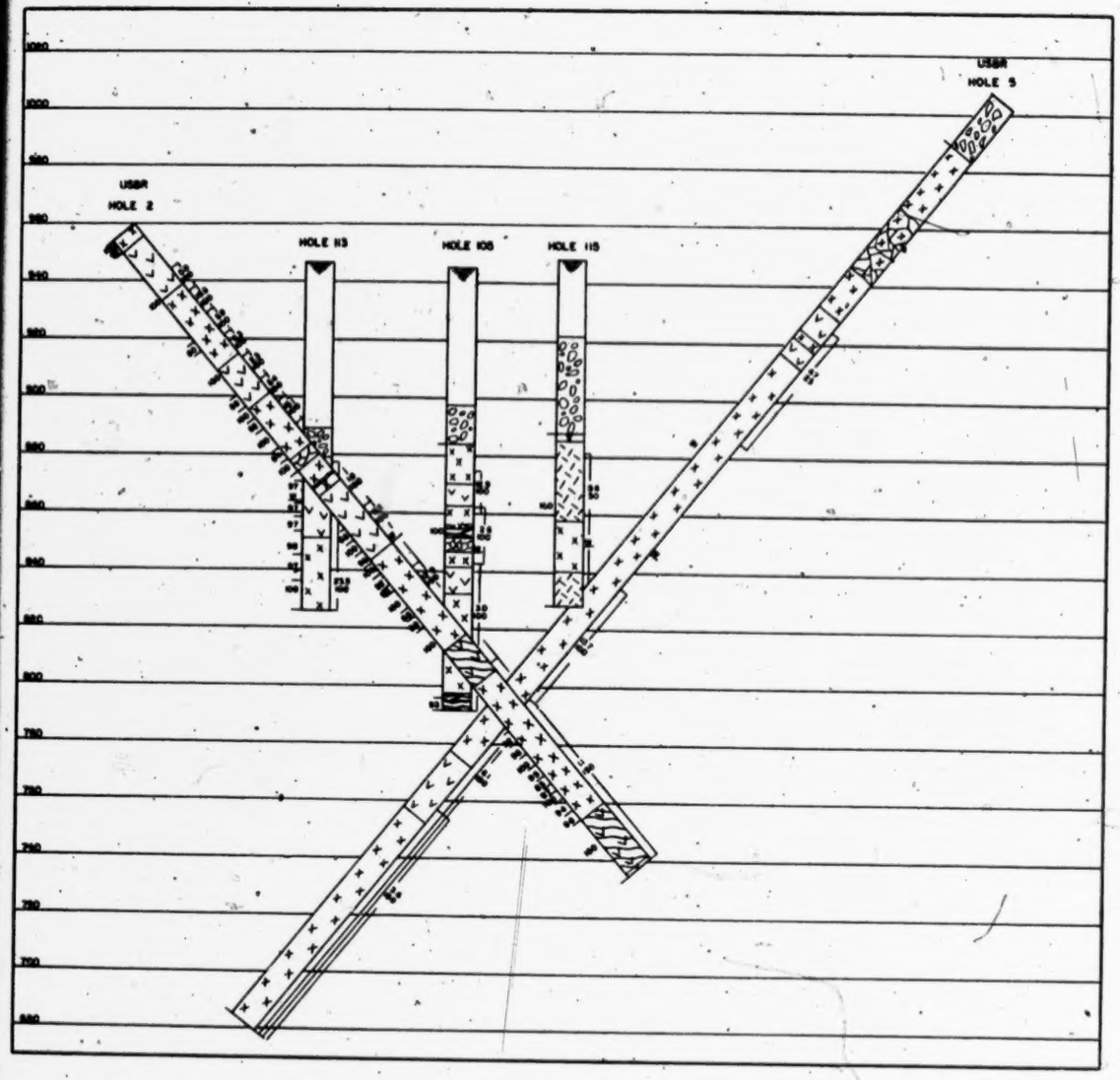


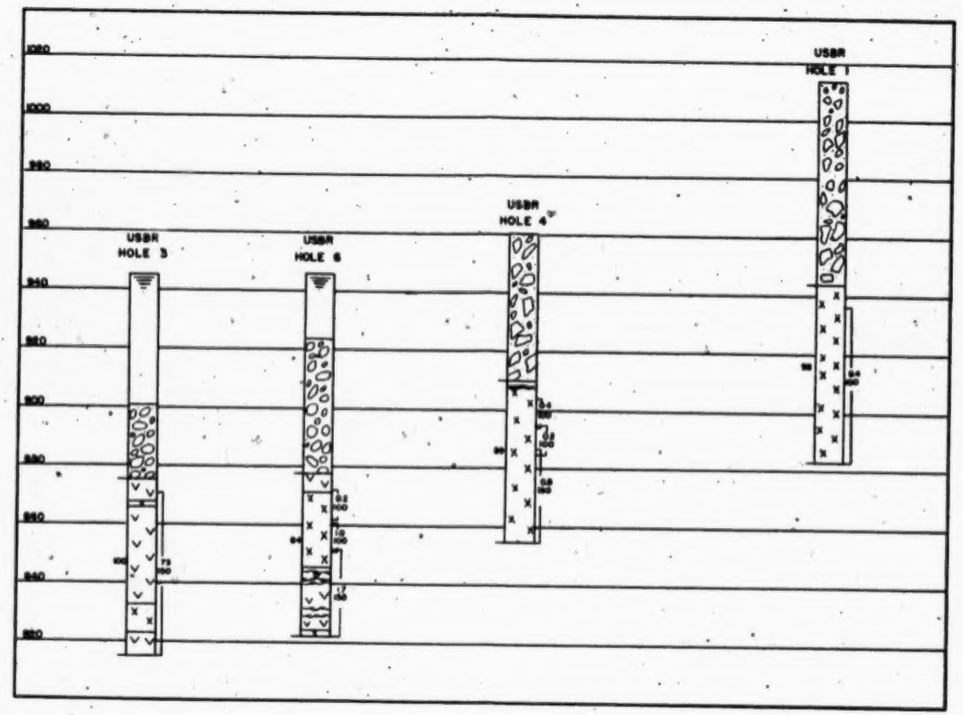
EXHIBIT L
SHEET 12

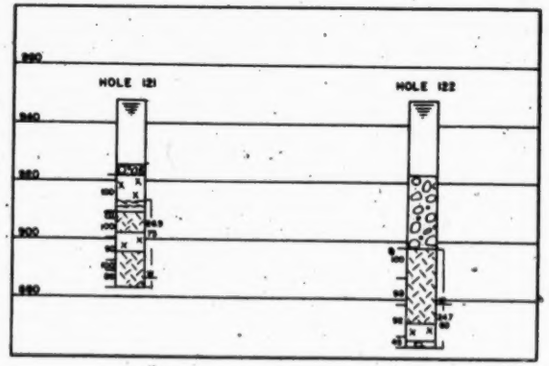
PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
LOGS OF DRIFTS & TUNNELS
SCALE 1" = 10'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

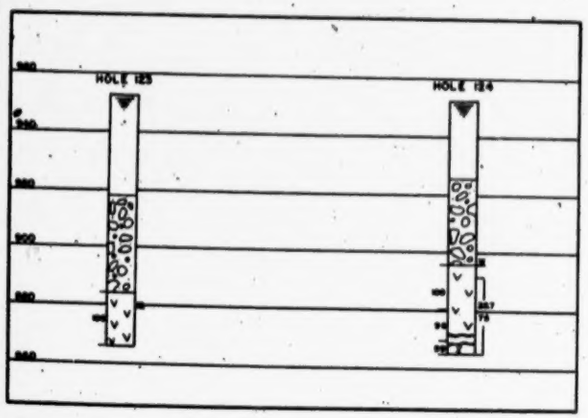
September, 1955

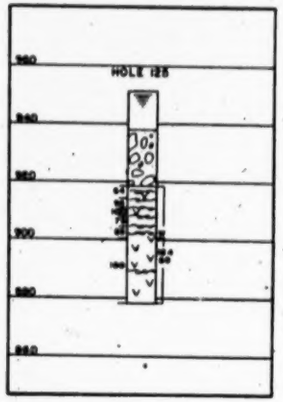
10-A-235











SCALE 0 20 FEET

NOTE:
FOR LOCATION OF DRILL HOLES SEE DWG. 10-A-219

LEGEND

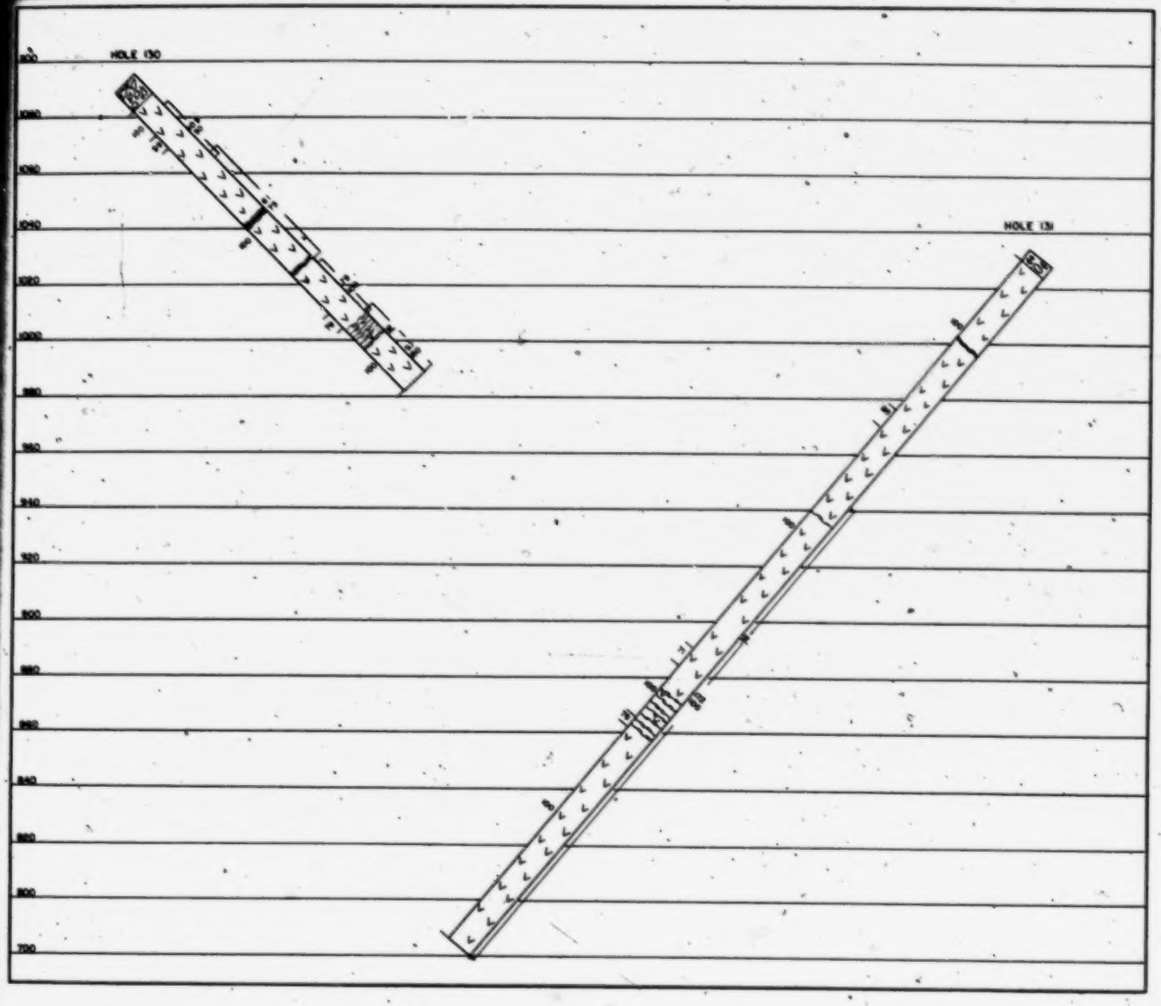
- OVERBURDEN
- GRANITE
- BASALT
- DIORITE
- METAVOLCANIC
- PERCENT CORE RECOVERY
- SHEAR ZONES
- IRON ORE
- FRACTURED ZONE
- CORE LOSS
- LIMIT OF WEATHERING
- WATER LOSS IN GPM
- WATER PRESSURE IN PSI

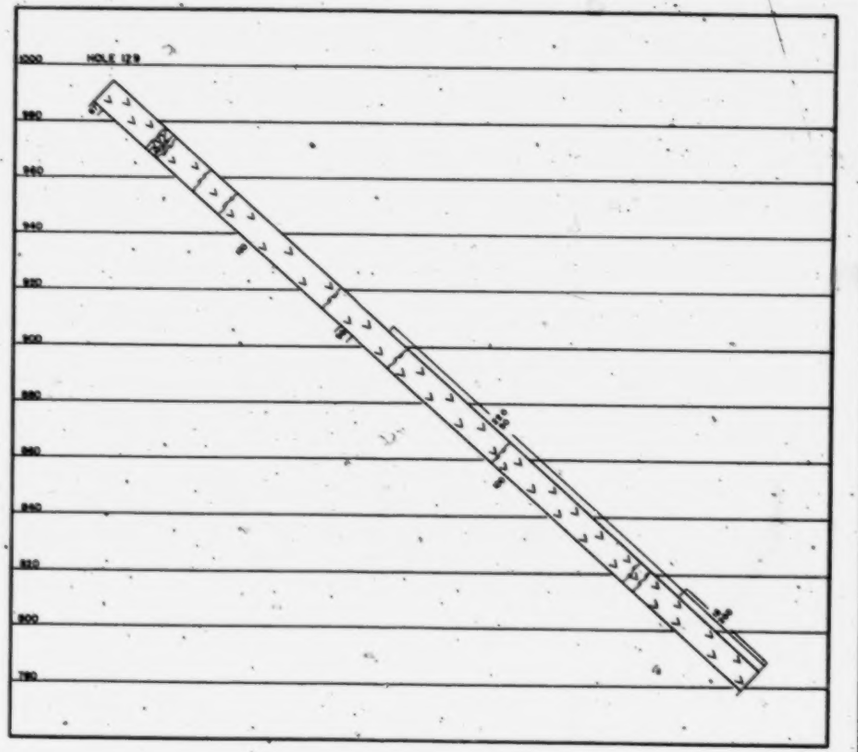
September, 1955

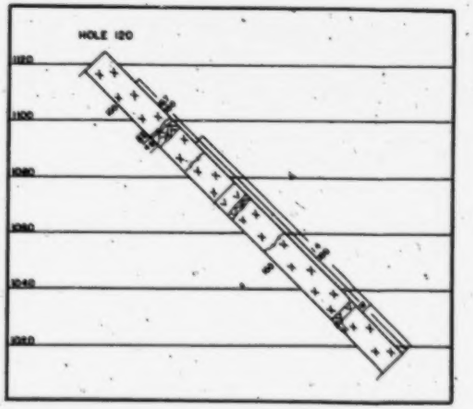
EXHIBIT L
SHEET 13

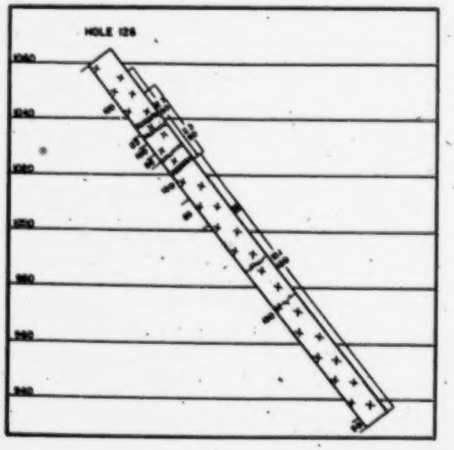
PROJECT NO 2173 IDAHO-OREGON
MOUNTAIN SHEEP H E DEVELOPMENT
DRILL HOLE LOGS
SCALE 1" = 20'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

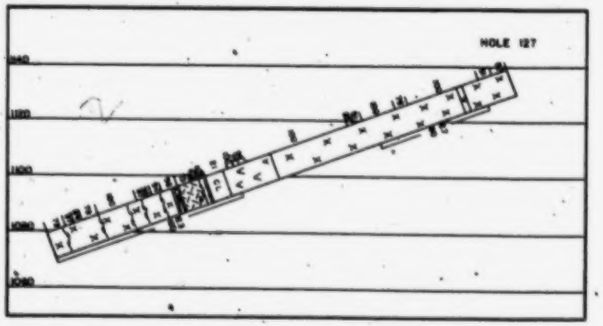
10-A-243











SCALE 0 50 FEET

NOTE:
FOR LOCATION OF DRILL HOLES SEE DWG. 10-A-229

EXHIBIT L
SHEET 14

LEGEND

- OVERBURDEN
- GRANITE
- BASALT
- DIORITE
- METAVOLCANIC
- PERCENT CORE RECOVERY
- SHEAR ZONES
- IRON ORE
- FRACTURED ZONE
- CORE LOSS
- LIMIT OF WEATHERING
- WATER LOSS IN GPM / WATER PRESSURE IN PSI September, 1958

PROJECT NO 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
DRILL HOLE LOGS
SCALE 1" = 20'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

10-A-244

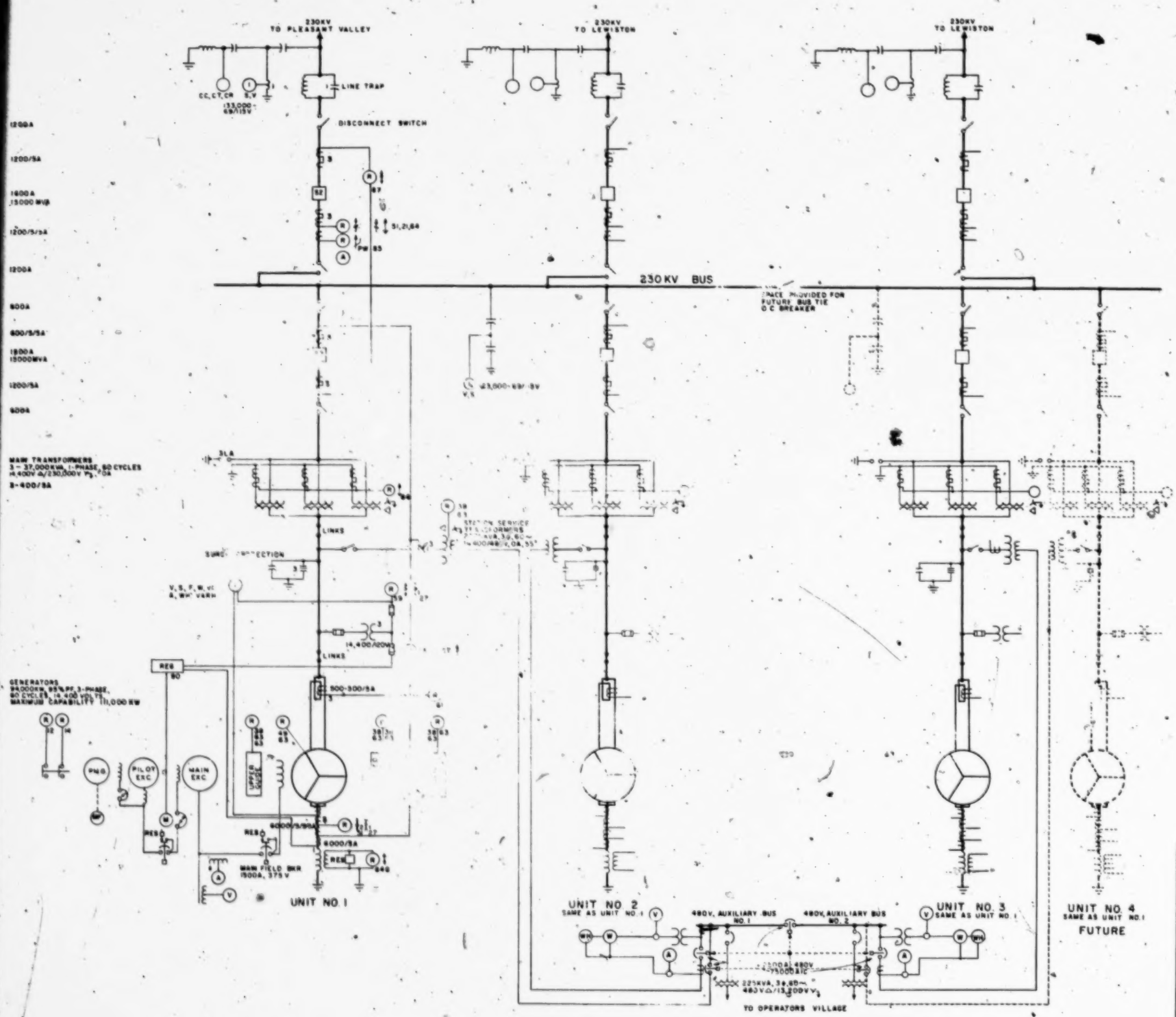
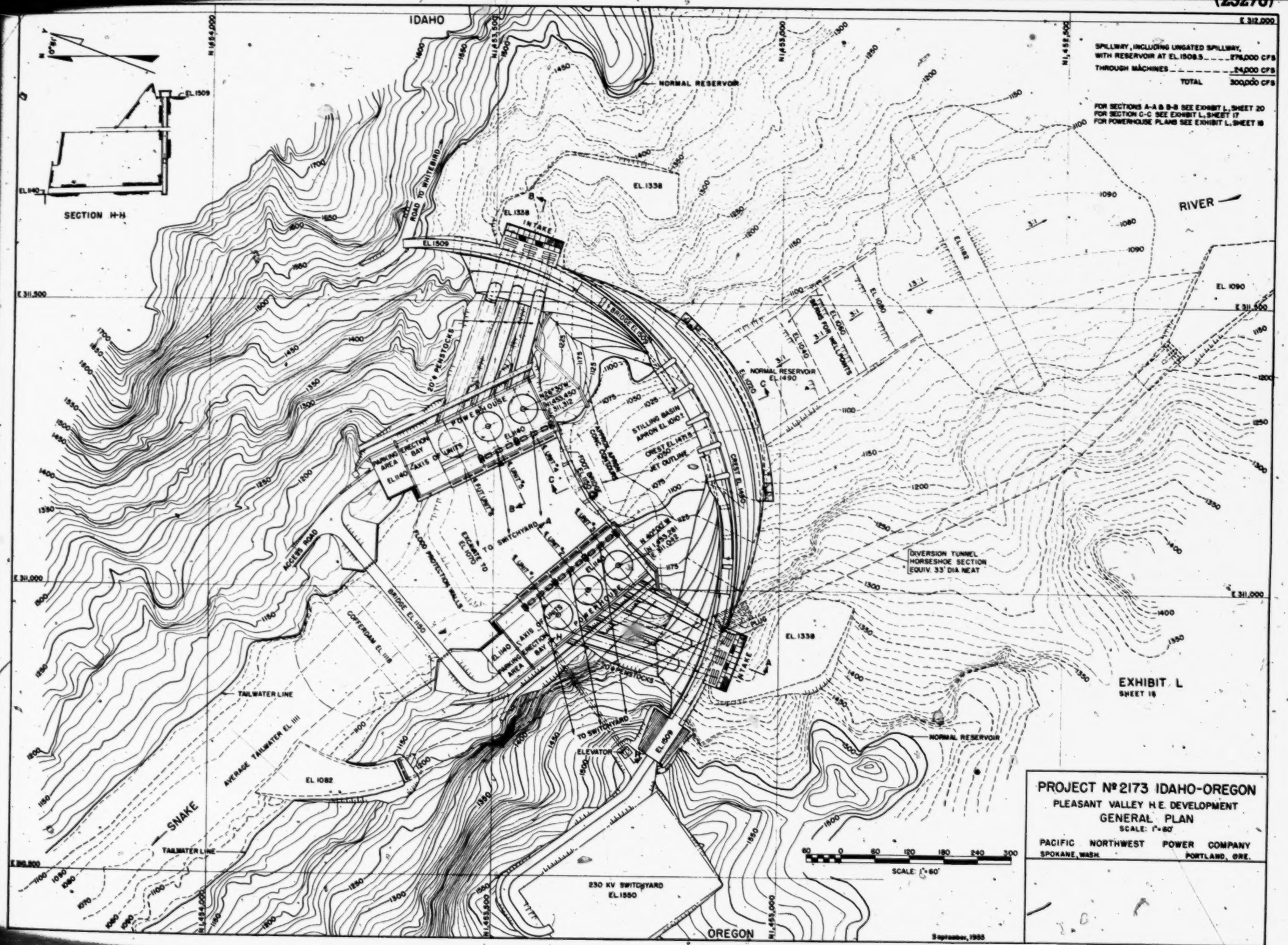
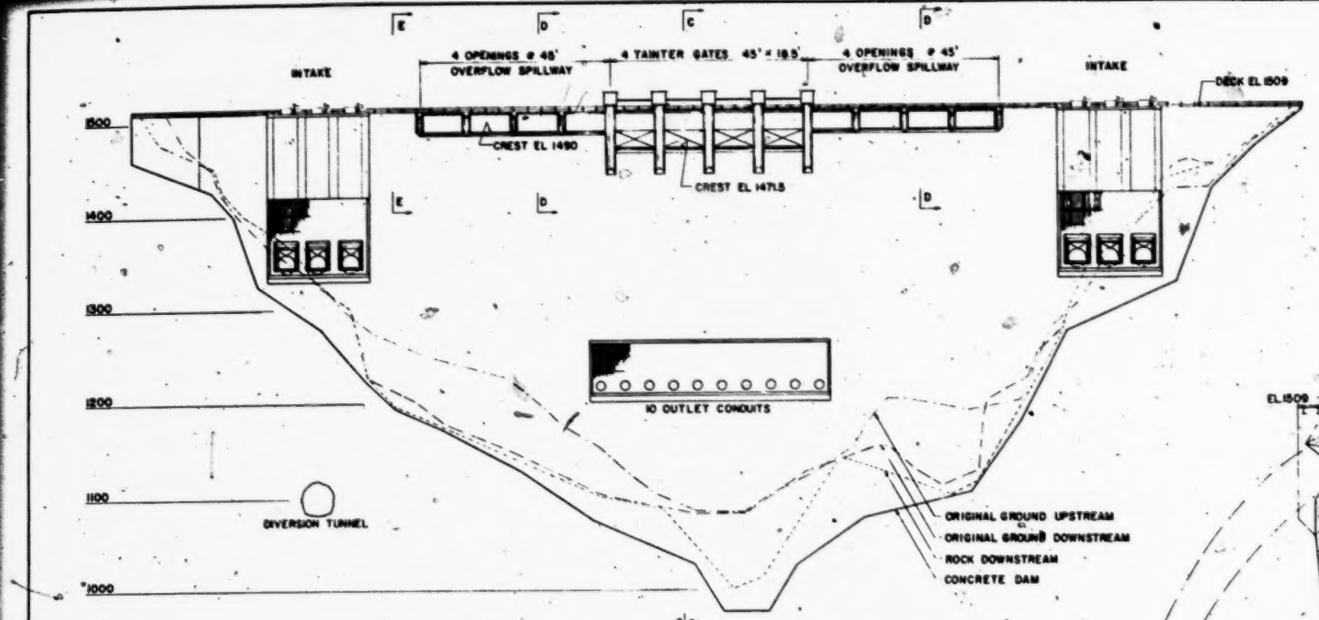


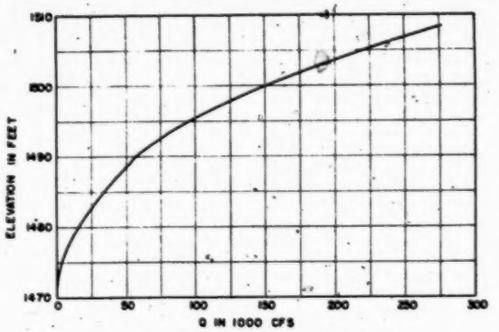
EXHIBIT L
SHEET 18

PROJECT NO. 2173 IDAHO-OREGON
MOUNTAIN SHEEP H.E. DEVELOPMENT
MAIN SINGLE LINE DIAGRAM
NO SCALE
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

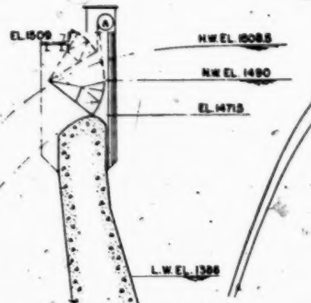

IDAHO
OREGON
SNAKE RIVER
NORMAL RESERVOIR
EL. 1509
EL. 1338
INTAKE
ROAD TO WHITEBIRD
SECTION H-H
EL. 1509
EL. 1440
SPILLWAY, INCLUDING UNGATED SPILLWAY, WITH RESERVOIR AT EL. 1508.5 ..... 276,000 CFS
THROUGH MACHINES ..... 24,000 CFS
TOTAL 300,000 CFS
FOR SECTIONS A-A & B-B SEE EXHIBIT L, SHEET 20
FOR SECTION C-C SEE EXHIBIT L, SHEET 17
FOR POWERHOUSE PLANS SEE EXHIBIT L, SHEET 18
BRIDGE EL. 1525
20 ø PENSTOCKS
POWERHOUSE
PARKING AREA
ERECTION BAY
CABLE OF UNITS
STILLING BASIN APRON EL. 1040'±
CREST EL. 1475.5
JET OUTLINE
CREST EL. 1460'
DIVERSION TUNNEL HORSESHOE SECTION EQUIV. 33' DIA NEAT
ACCESS ROAD
FLOOD PROTECTION WALLS
BRIDGE EL. 1150
COFFERDAM EL. 1118
TAILWATER LINE
AVERAGE TAILWATER EL. 1111
EL. 1082
TO SWITCHYARD
ELEVATOR
EL. 1509
230 KV SWITCHYARD EL. 1550
EXHIBIT L
SHEET 16
PROJECT Nº 2173 IDAHO-OREGON
PLEASANT VALLEY H.E. DEVELOPMENT
GENERAL PLAN
SCALE: 1"=60'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.
SCALE: 1"=60'
September, 1955
G-140534

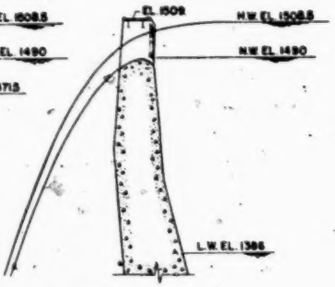


DEVELOPED PROFILE LOOKING DOWNSTREAM
SCALE: 1" = 60'



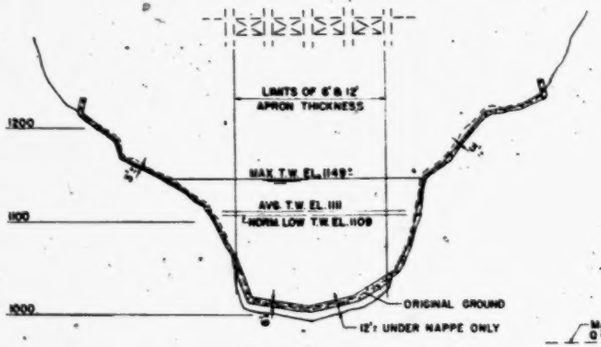
DISCHARGE CURVE FOR ARCH SPILLWAY





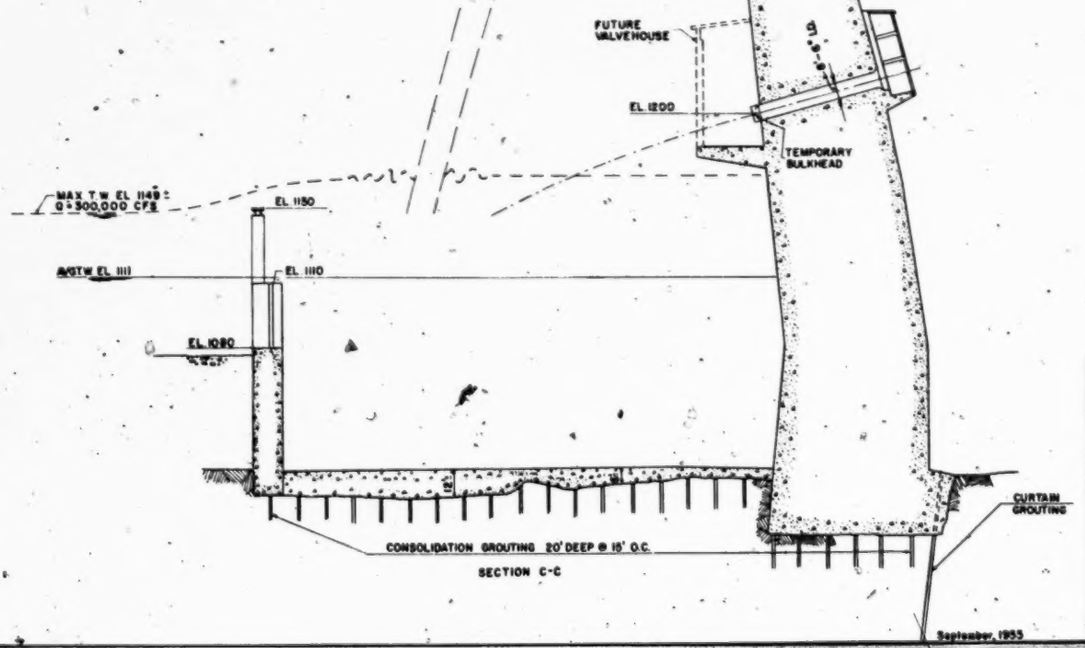
SECTION D-D

SECTION E-E



SECTION THRU APRON LOOKING DOWNSTREAM
SCALE: 1" = 60'

SCALE: 1" = 30'

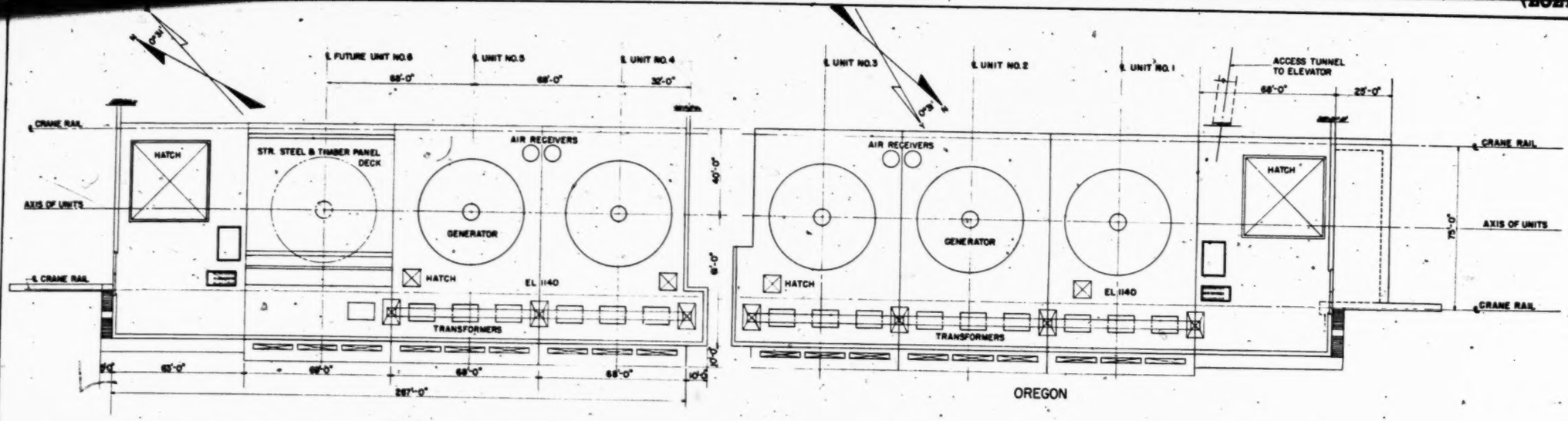


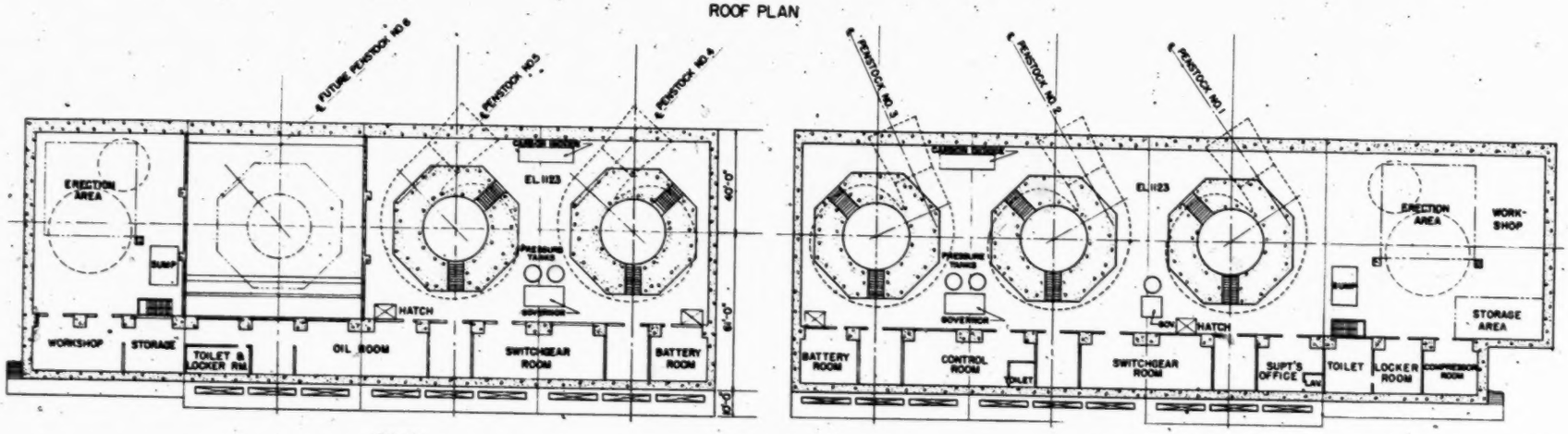
SECTION C-C

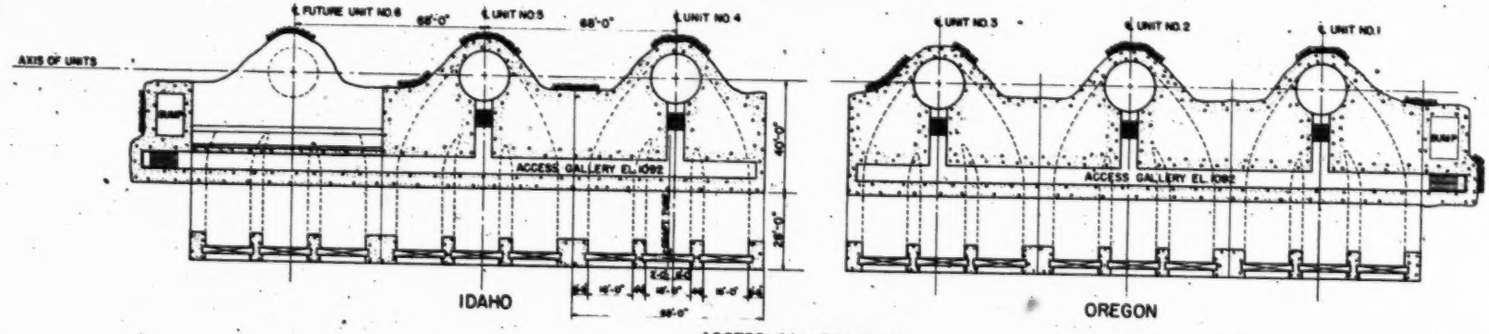
EXHIBIT L
SHEET 17

PROJECT N°2173 IDAHO-OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
PROFILE AND SECTIONS OF DAM
SCALE: 1"=30' UNLESS NOTED
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1953





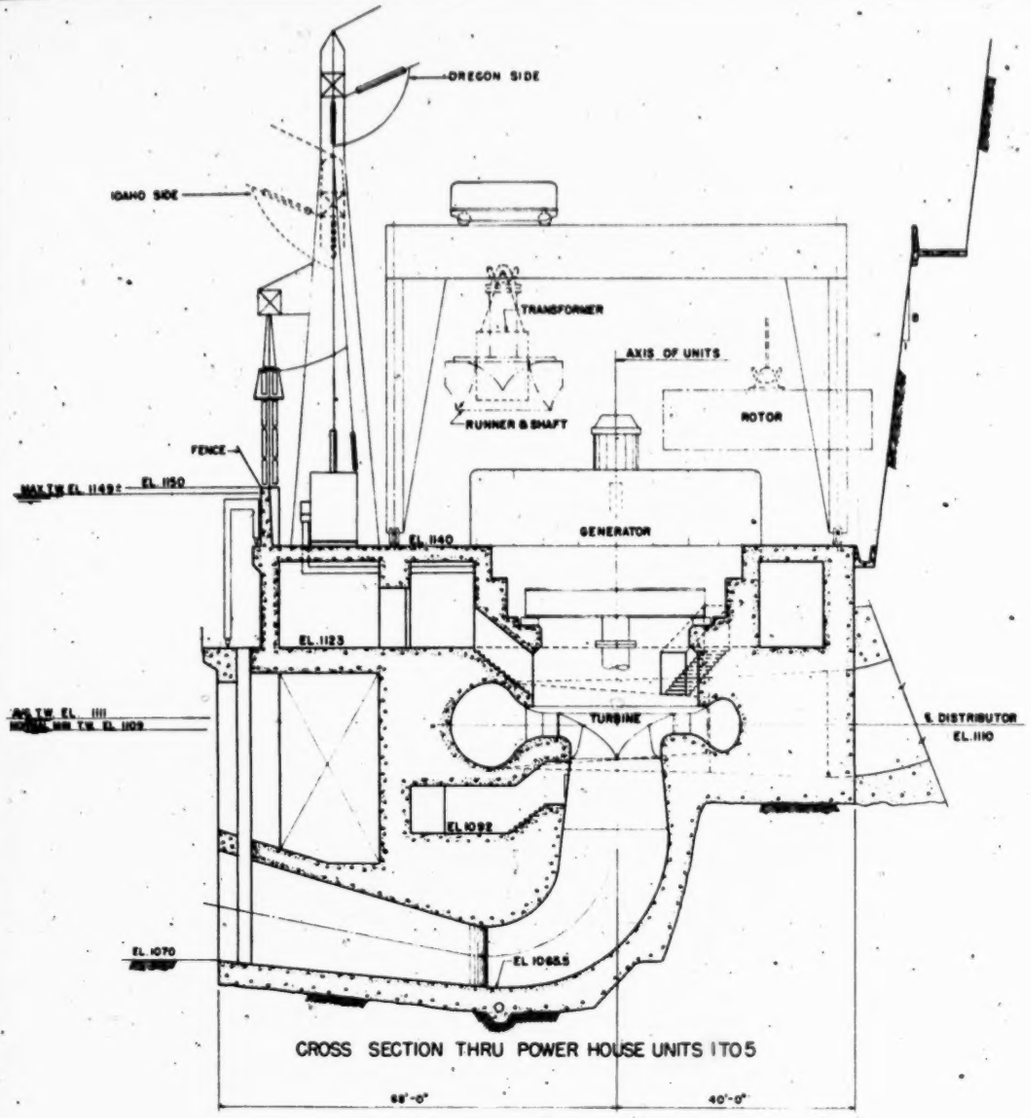


SCALE: 1" = 20'

EXHIBIT L
SHEET 18

PROJECT N°2173 IDAHO-OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
POWER HOUSE PLANS
SCALE: 1" = 20'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1955.



CROSS SECTION THRU POWER HOUSE UNITS 1 TO 5

ALLOWABLE STRESSES

CONCRETE: ARCH DAM 1000 LB. PER SQ. IN. WITH FACTOR OF SAFETY OF 4.

OTHER CONCRETE: AMERICAN CONCRETE INSTITUTE BUILDING CODE FOR REINFORCED CONCRETE. ALLOWABLE STRESSES FOR CONCRETE HAVING AN ULTIMATE STRENGTH OF 3000 LB. PER SQ. IN. EXCEPT CONCRETE FILL AND OTHER SPECIAL CONCRETE.

STEEL: PENSTOCKS ALLOWABLE UNIT STRESS 18000 LB. PER SQ. IN. WELDED JOINT EFFICIENCY 90 %

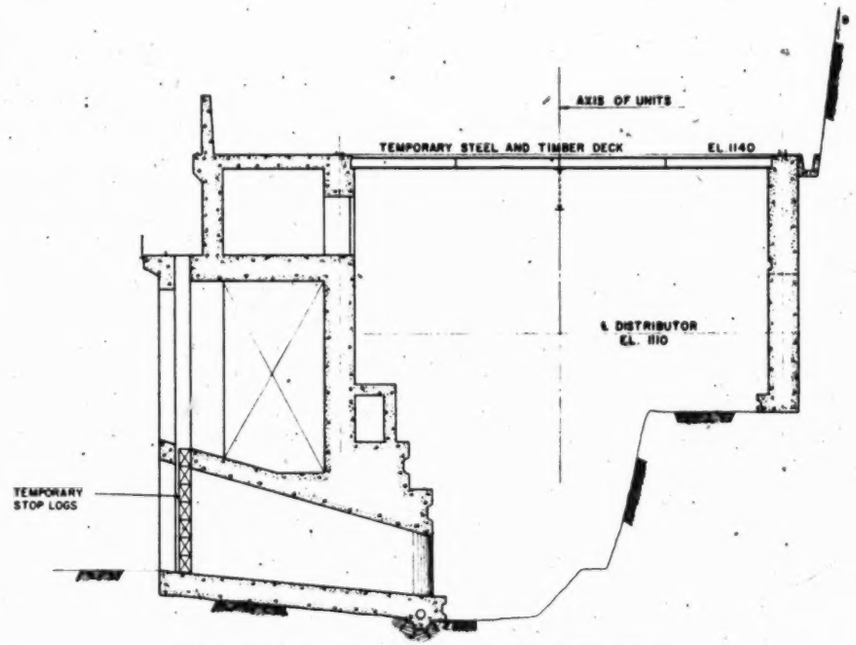
INTAKE GATES AND SCREENS: 18000 LB. PER SQ. IN.

DRAFT TUBE GATES: 20000 LB. PER SQ. IN. - NORMAL TAILWATER
27000 LB. PER SQ. IN. - MAX. TAILWATER

DIVERSION GATES: 20000 LB. PER SQ. IN. WITH HEADWATER ANTICIPATED AT TIME OF CLOSURE
[illegible]0 LB. PER SQ. IN. WITH MAX. HEADWATER

OTHER STRUCTURE: AMERICAN INSTITUTE OF STEEL CONSTRUCTION "SPECIFICATION FOR DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS"

EARTHQUAKE: ALL STRUCTURES DESIGNED FOR 0.1G



CROSS SECTION THRU POWER HOUSE FUTURE UNIT 6

EQUIPMENT

TURBINE: FIVE - 233,600 H.P. AT 331 FT. NET HEAD, FULL GATE 128.6 R.P.M.

GENERATOR: FIVE - 144,000 K.W., 0.95 P.F., 3-PHASE, 60-CYCLE, MAXIMUM CAPABILITY 170,000 K.W.

MAIN TRANSFORMER: FIFTEEN SINGLE PHASE, 60 CYCLE, 13.8 - 230 K.V. 56,667 K.V.A., PLUS ONE SPARE

INTAKE GATES: FIXED WHEEL TYPE, 23.0 FT. WIDE BY 23.8 FT. HIGH, ONE FOR EACH PENSTOCK, 200 T. CAPACITY INDIVIDUAL HOIST

DRAFT TUBE GATE: TWO SETS OF 3 GATES EACH, SLIDE TYPE, 18 FT. WIDE BY 19 FT. HIGH.

MAIN GANTRY CRANE: ONE FOR EACH POWER HOUSE, 700 TON CAPACITY.

DRAFT TUBE GATE GANTRY: ONE FOR EACH POWER HOUSE, 20 TON CAPACITY

10 0 10 20 30 40 50

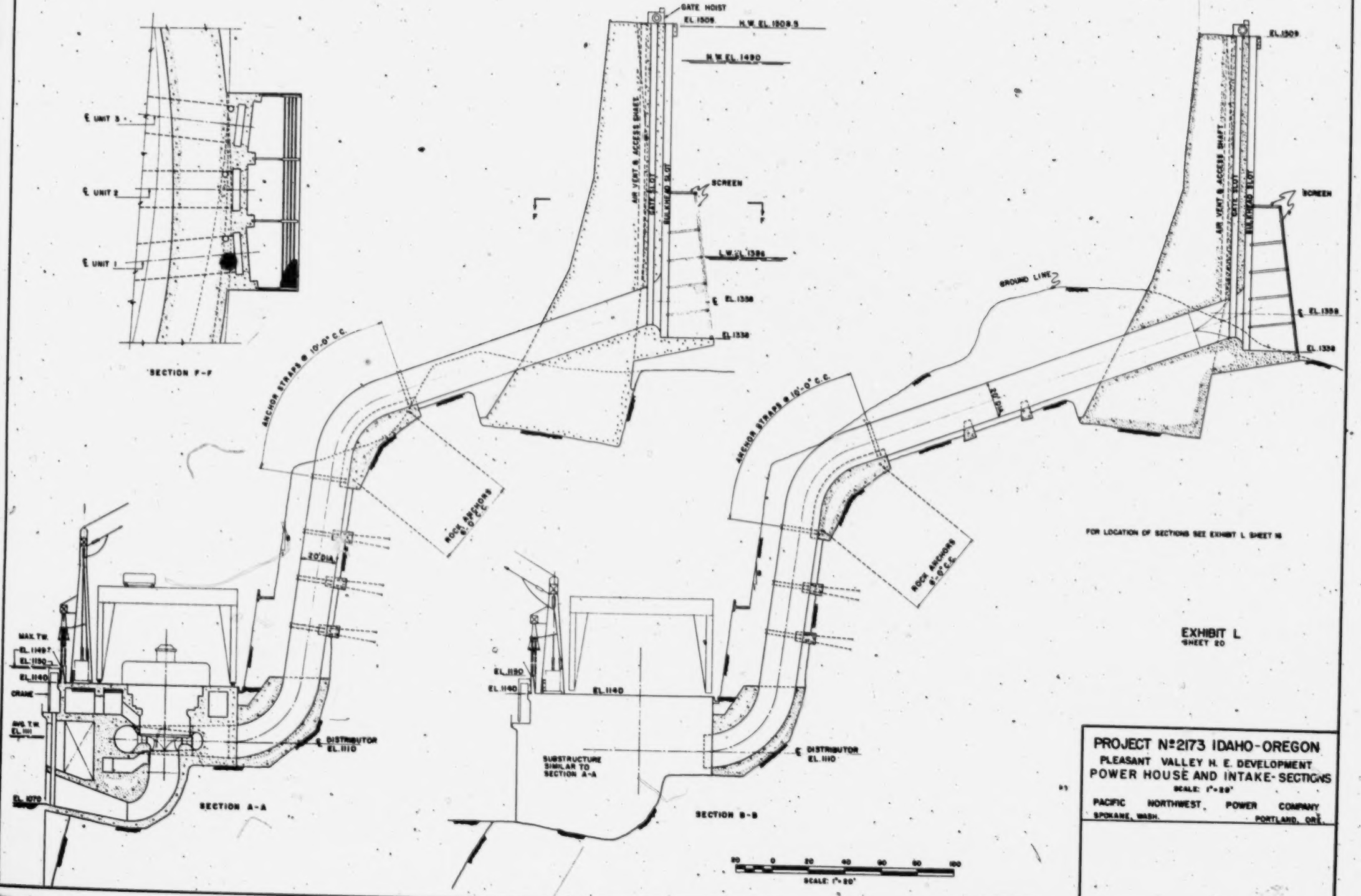
SCALE: 1" = 10'

EXHIBIT L
SHEET 19

PROJECT Nº2173 IDAHO - OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
POWER HOUSE CROSS SECTIONS
SCALE: 1" = 10'

PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

SECTION F-F



SECTION A-A

SECTION B-B

FOR LOCATION OF SECTIONS SEE EXHIBIT L SHEET 16

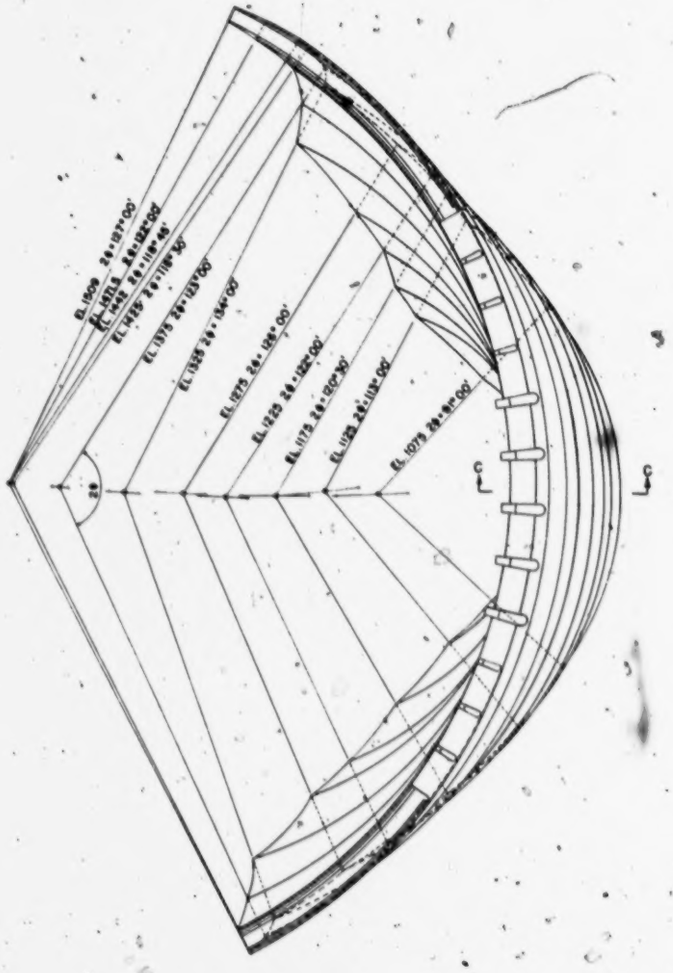
EXHIBIT L
SHEET 20

PROJECT Nº2173 IDAHO-OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
POWER HOUSE AND INTAKE-SECTIONS
SCALE: 1"=20'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

SCALE: 1"=20'

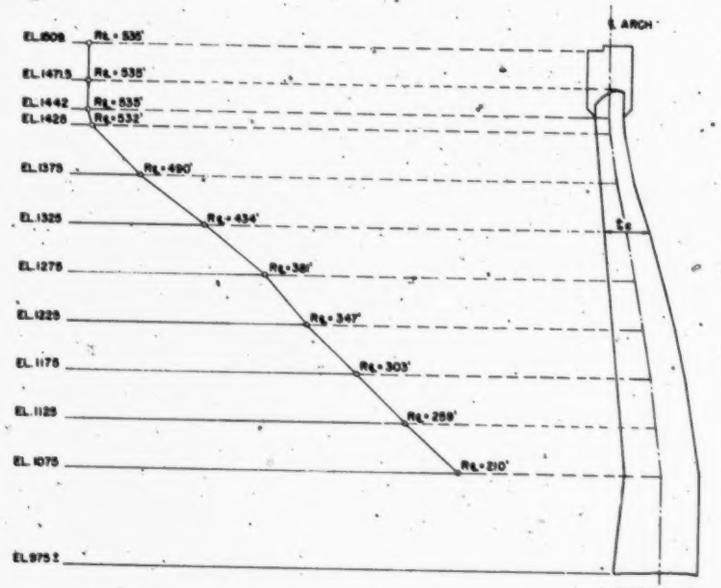
September, 1950.

G-140528



LEGEND

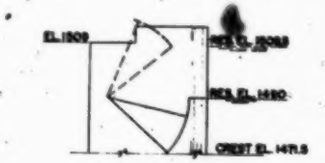
CENTER OF CURVATURE FOR EXTRADOS
CENTER OF CURVATURE FOR R_E
CENTER OF CURVATURE FOR INTRADOS



SECTION C-C

ELEVATION	ARCH DIMENSIONS						ARCH STRESSES (LBS/SQ. IN)											
							CASE I				CASE II				CASE III			
							CROWN		ABUT.		CROWN		ABUT.		CROWN		ABUT.	
							EXT.	INT.	EXT.	INT.	EXT.	INT.	EXT.	INT.	EXT.	INT.	EXT.	INT.
1509	15	15	1.0	127.00	536													
1471.5	212	212	1.0	122.50	535													
1442	26	26	1.0	119.75	535	049	490	380	297	577	785	558	408	942	710	497	380	852
1425	28	28	1.0	118.50	532	048	683	513	402	760	881	630	467	1048	903	647	481	1077
1375	35	42	1.2	113.00	490	072	895	583	345	872	1088	610	338	1072	1140	659	368	1147
1325	47	52	1.3	104.00	434	108	872	478	247	842	997	497	217	988	1086	540	242	1109
1275	26	784	1.4	128.00	381	147	922	344	85	902	1032	331	2	1042	1131	388	9	1140
1225	85	91	1.4	122.00	347	188	940	238	-27	979	1031	220	-91	1100	1131	246	-94	1207
1175	71	1065	1.5	120.50	303	234	914	142	-94	945	982	121	-147	1042	1080	136	-157	1139
1125	74	111	1.5	115.00	259	286	838	32	-148	950	884	28	-178	1018	998	28	-190	1110
1075	77	100	1.3	91.00	210	370	690	-91	-312	897								

CASE I WATER LOAD TO EL. 1490.
CASE II WATER LOAD TO EL. 1508.5 PLUS TEMPERATURE STRESSES.
CASE III WATER LOAD TO EL. 1490 PLUS TEMPERATURE AND EARTHQUAKE STRESSES.

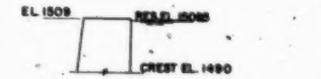


CASE I: RES. LEVEL AT EL. 1490
GATES BOTH SIDES CLOSED.

CASE II: RES. LEVEL AT 1508.5
GATES BOTH SIDES OPEN.

CASE III: RES. LEVEL AT EL. 1490
ONE GATE CLOSED AND THE
OTHER FULLY OPEN

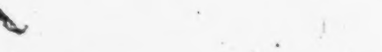
STRESS DIAGRAM FOR PIERS
WITH CONTROL GATES



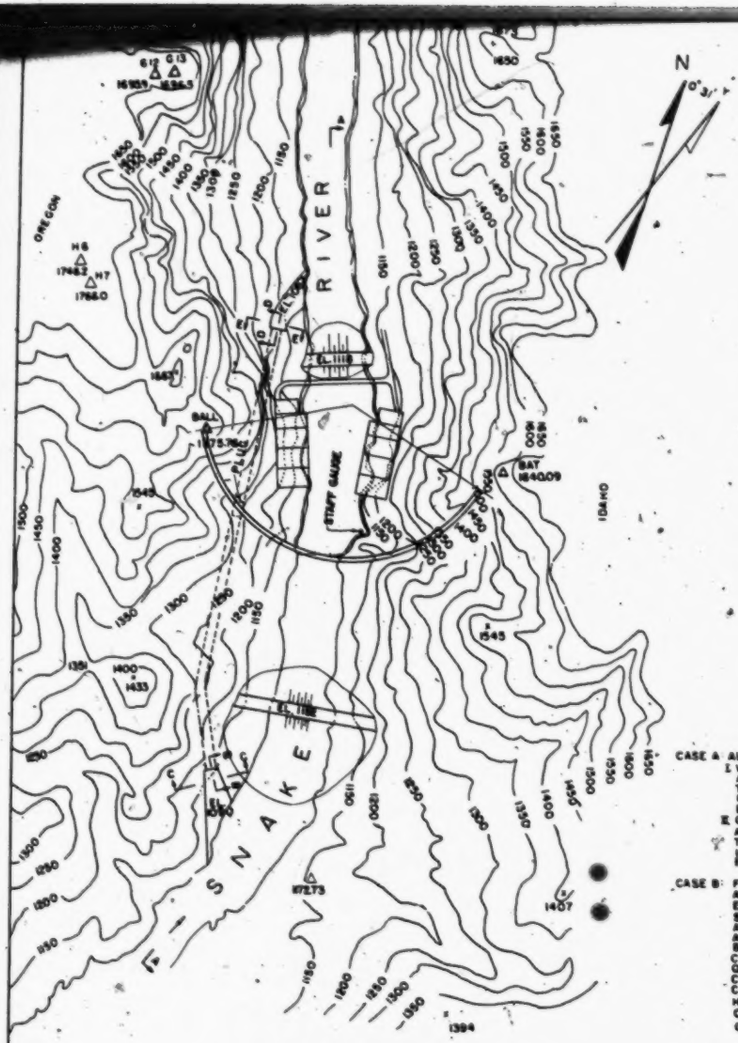
STRESS DIAGRAM FOR PIERS
WITHOUT CONTROL GATES

(ASSUMED UPLIFT PRESSURE = 50% OF HYDROSTATIC PRESSURE.)

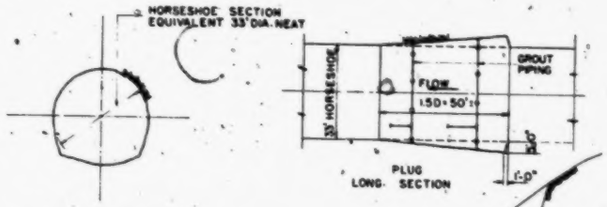
EXHIBIT L
SHEET 21



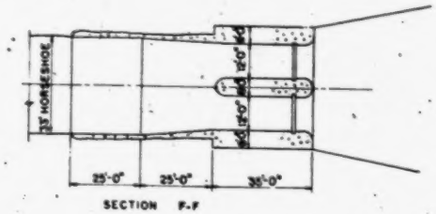
PROJECT Nº2173 IDAHO-OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
ARCH DAM
SCALE: 1" = 60'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.



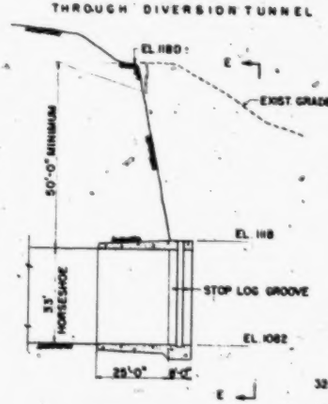
PLAN
SCALE: 1"=200'



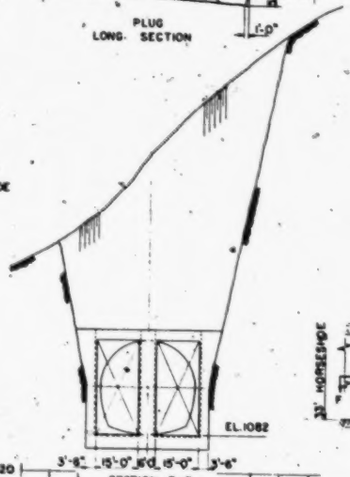
TYPICAL SECTION
THROUGH DIVERSION TUNNEL



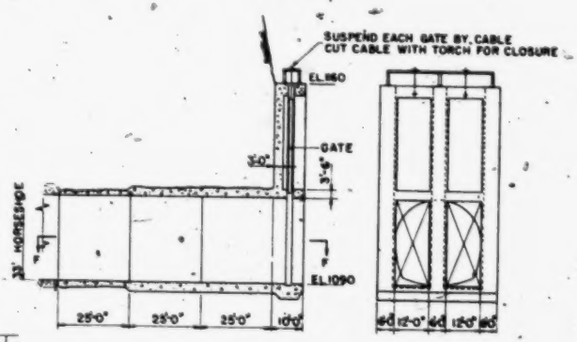
SECTION F-F



SECTION D-D



SECTION E-E



SECTION B-B

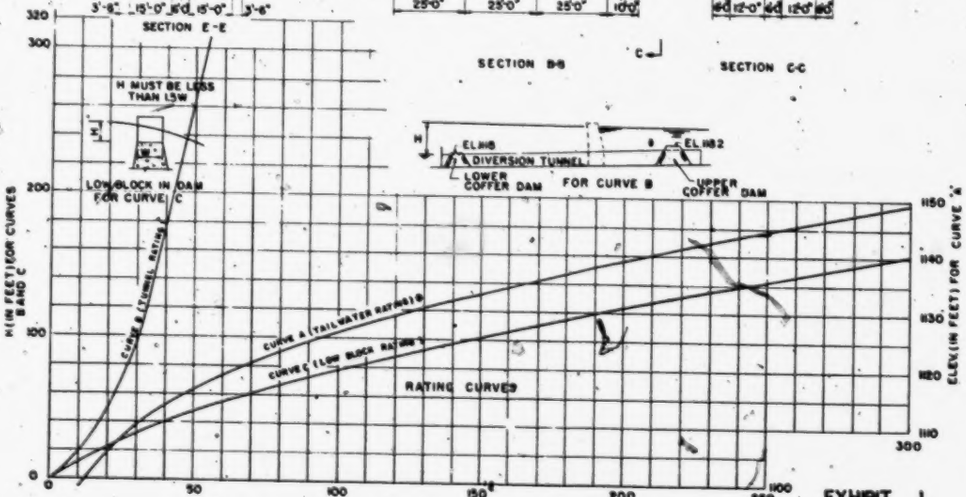
SECTION C-C

USE OF RATING CURVES

CASE A: ALL FLOW THROUGH DIVERSION TUNNEL
I. WITHOUT OVERTOPPING UPSTREAM COFFERDAM
ASSUME FLOW IN RIVER - 18000 CFS
T.W. ELEV. (CURVE A) 1105
HEADLOSS IN DIVERSION TUNNEL (CURVE B) 40'
ELEV. HEADWATER = 1105+40 = 1145
II. OVERTOPPING UPSTREAM COFFERDAM
ASSUME FLOW IN RIVER - 40000 CFS
TAILWATER ELEV. (CURVE A) 113
HEADLOSS IN DIVERSION TUNNEL (CURVE B) 177'
ELEV. HEADWATER = 1113+177 = 1290

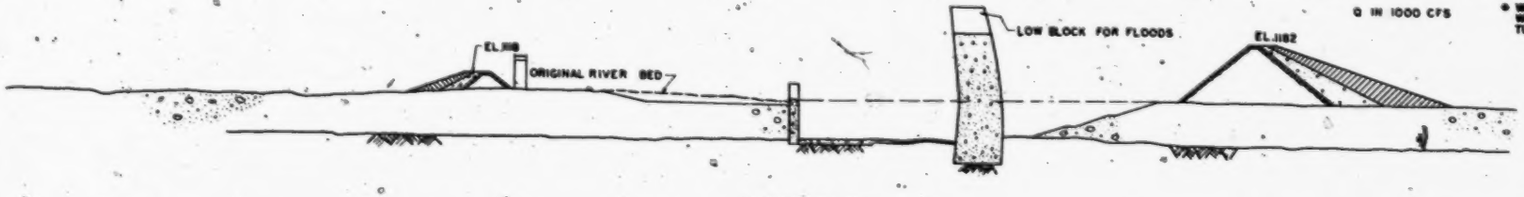
CASE B: FLOW THROUGH BOTH DIVERSION TUNNEL AND LOW BLOCK IN DAM
ELEVATION OF LOW BLOCK DEPENDS UPON STAGE OF CONSTRUCTION.
ASSUME LOW BLOCK SILL AT ELEV. 1200
ASSUME FLOW IN RIVER 40000 CFS.
BY TRIAL OBTAIN COMBINED Q FROM CURVES A, B & C.

Q TUNNEL		30500 CFS
CURVE A, TW. ELEV.	113	
CURVE B, H	98	
HEADWATER ELEV	1211	
CURVE C, H	11	
Q LOW BLOCK		9500 CFS
TOTAL Q		40000 CFS



* WATER SURFACE AT STAFF GAUGE (SEE PLAN). WATER SURFACE AT EXIT FROM DIVERSION TUNNEL APPROXIMATELY 01 FT LOWER.

EXHIBIT L
SHEET 22



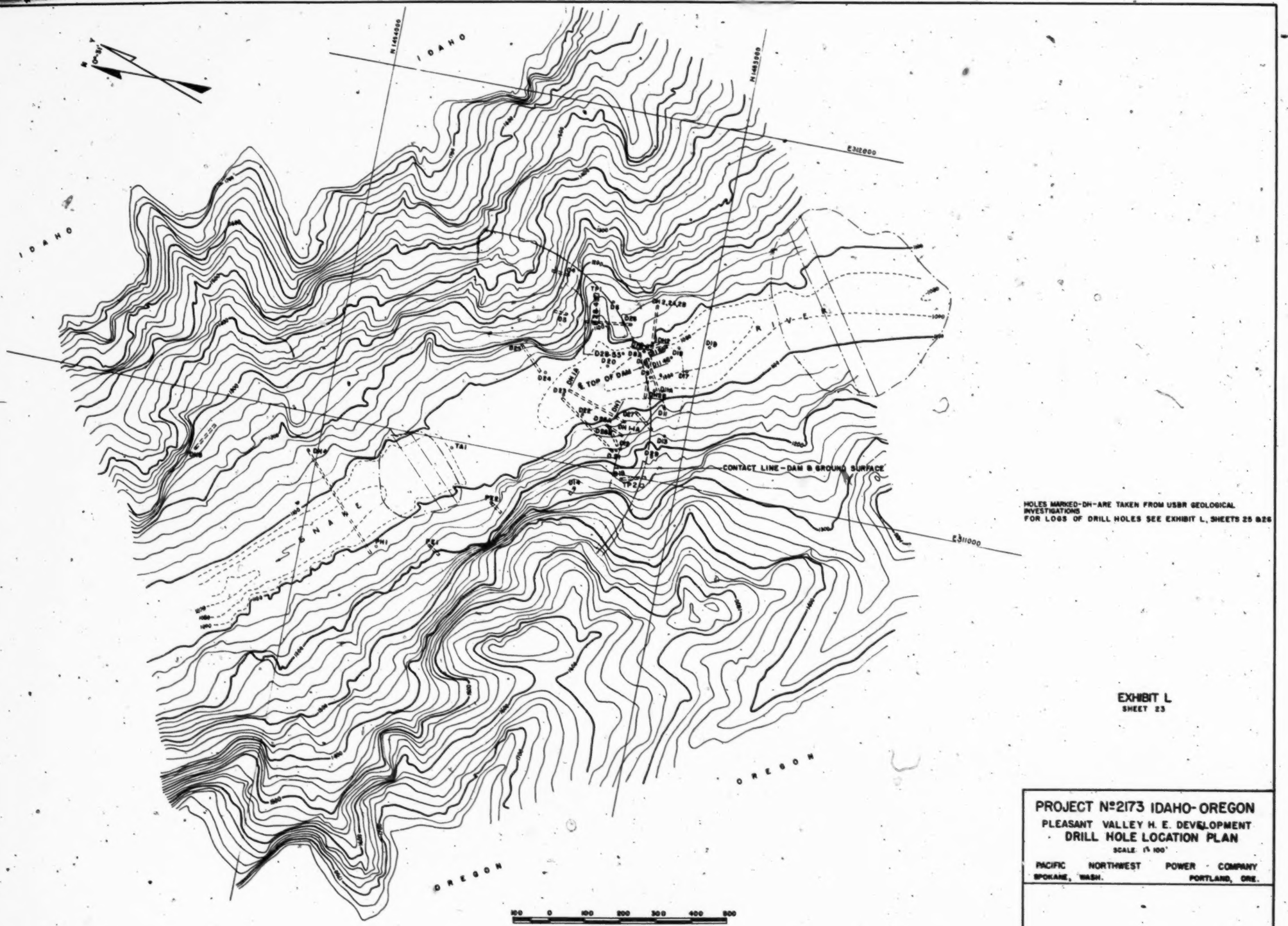
SECTION A-A
SCALE: 1"=100'

SCALE: 1"=20'

PROJECT №2173 IDAHO-OREGON
PLEASANT VALLEY H. E DEVELOPMENT
DIVERSION FACILITIES
SCALE: 1"=20' UNLESS NOTED
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1955.

G-140530
204

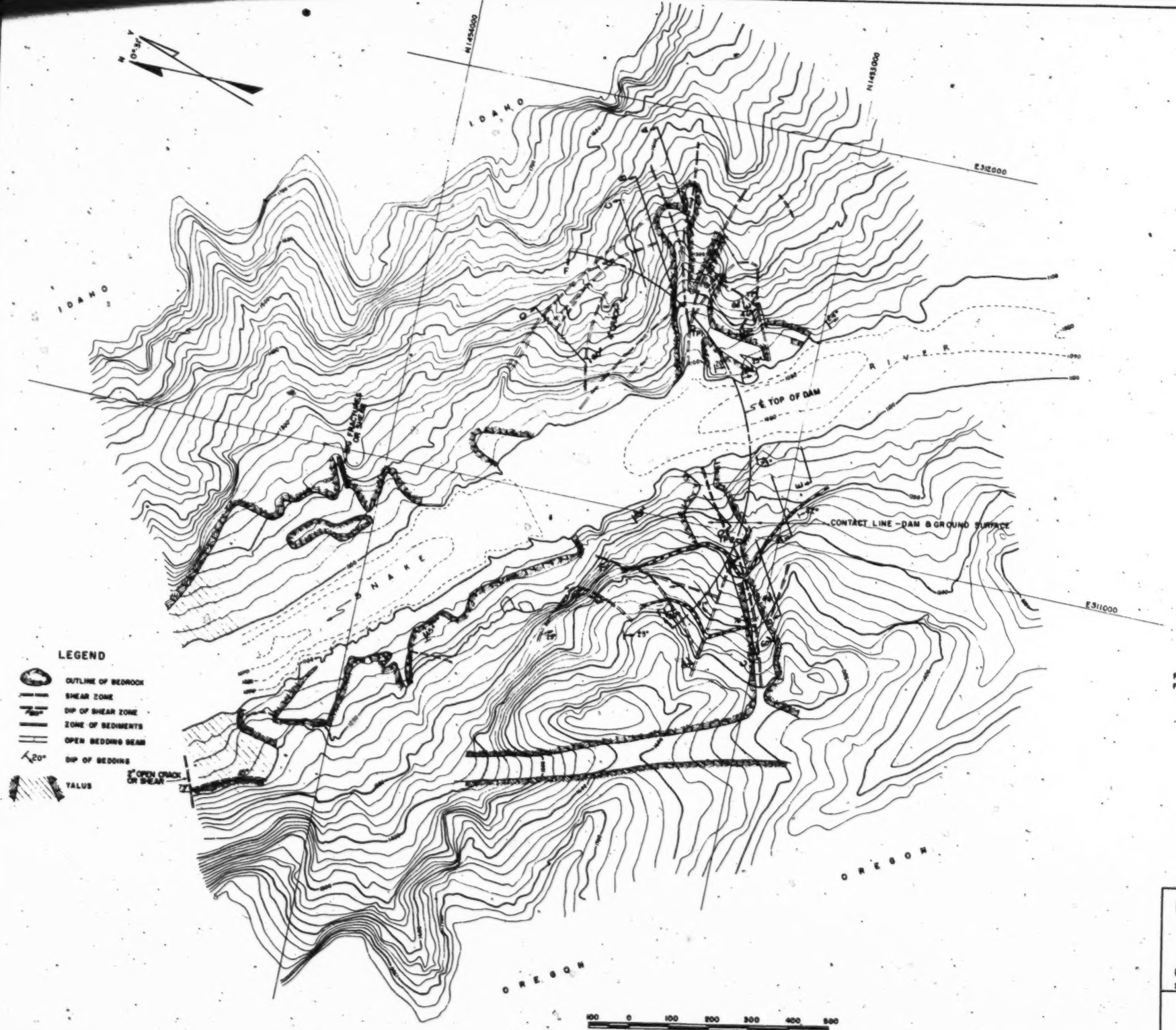


HOLES MARKED-DH-ARE TAKEN FROM USBR GEOLOGICAL INVESTIGATIONS
FOR LOGS OF DRILL HOLES SEE EXHIBIT L, SHEETS 25 & 26

EXHIBIT L
SHEET 23

PROJECT Nº2173 IDAHO-OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
DRILL HOLE LOCATION PLAN
SCALE 1" = 100'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

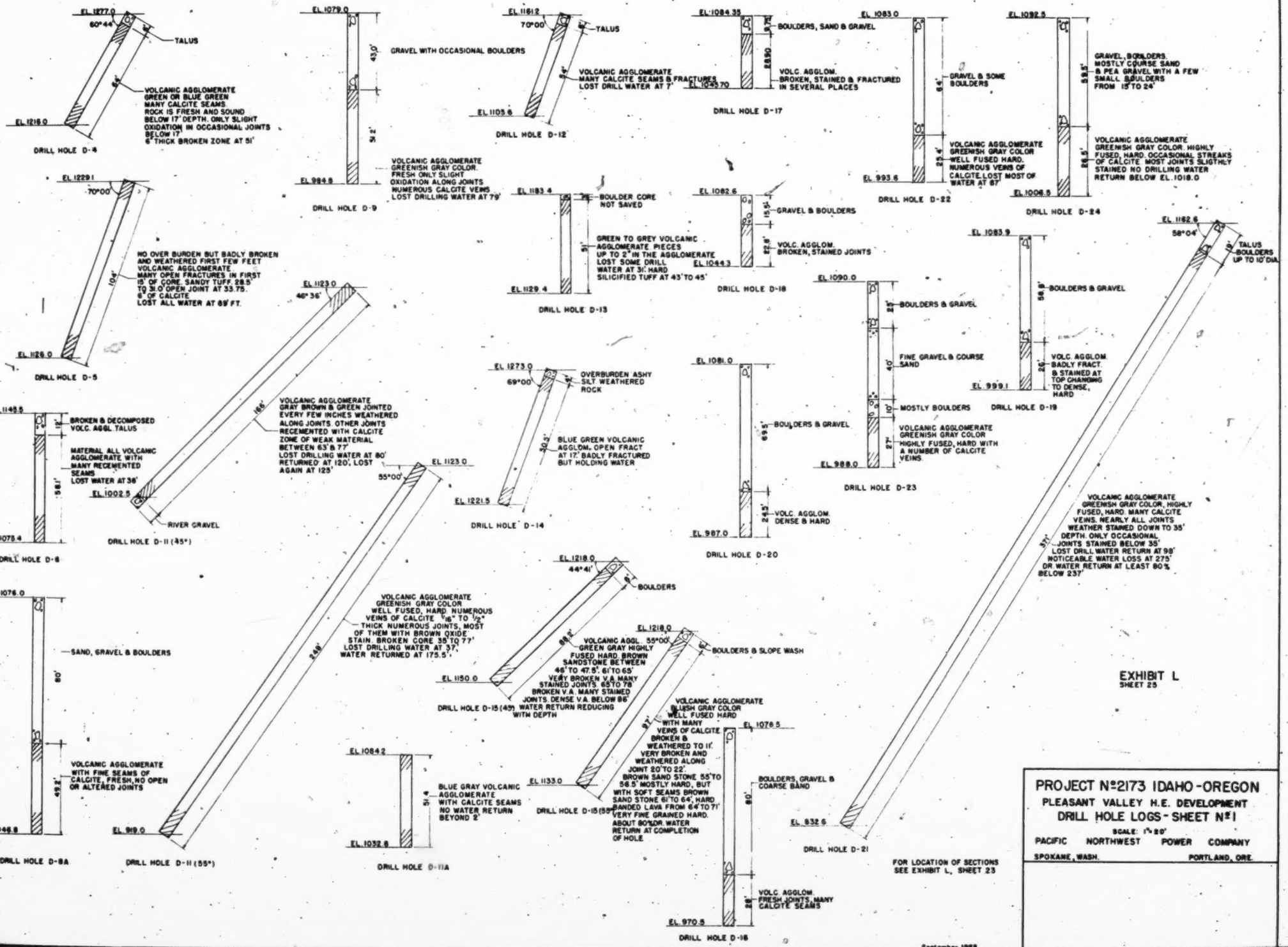
September, 1955.

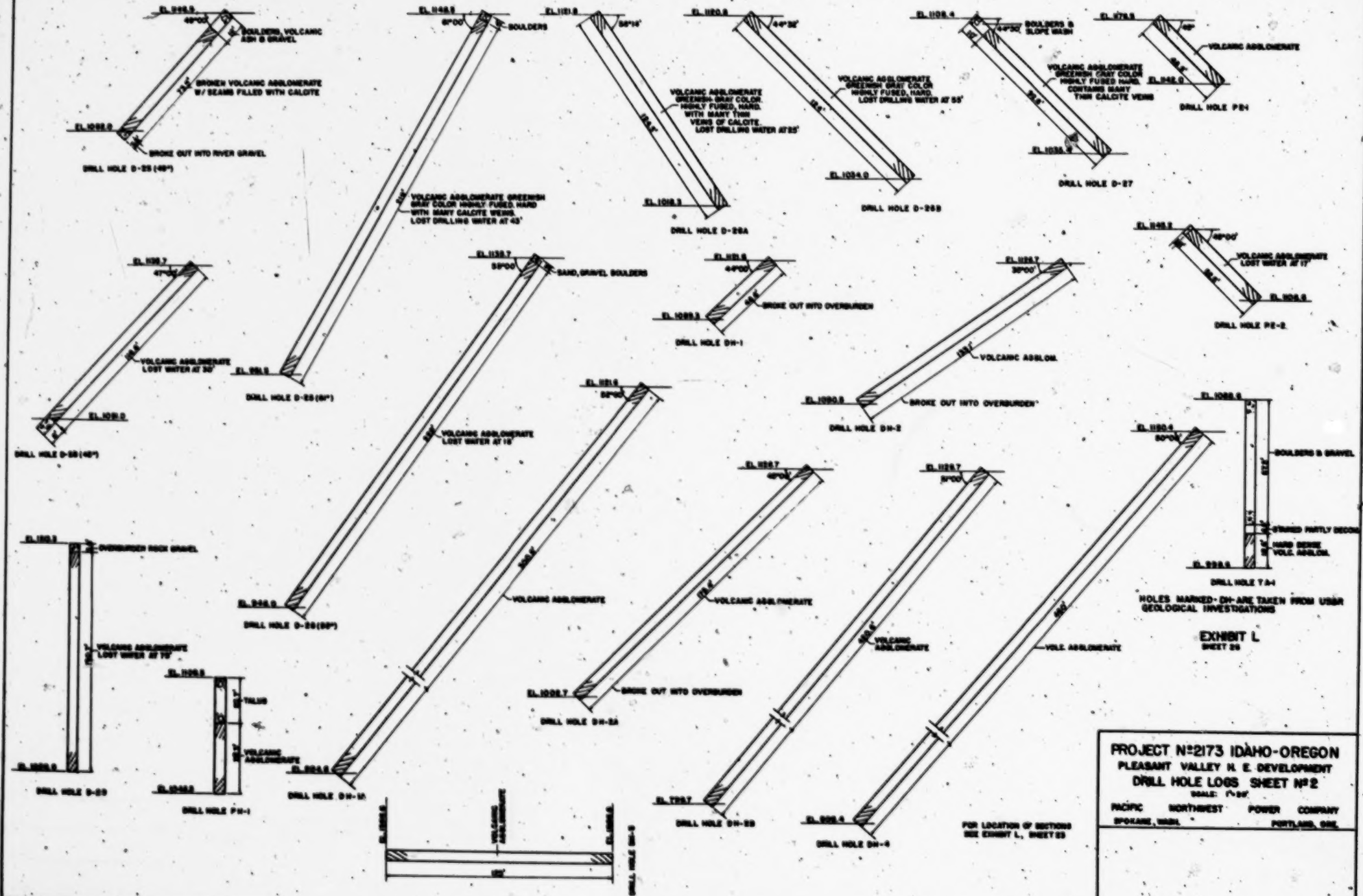


FOR SECTION F-F SEE EXHIBIT L, SHEET 28
FOR OTHER SECTIONS SEE, EXHIBIT L, SHEET 27

EXHIBIT L
SHEET 24

PROJECT Nº2173 IDAHO-OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
GEOLOGICAL EXPLORATION PLAN
SCALE: 1"=100'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.


EL. 1277.0
60°44'
TALUS
VOLCANIC AGGLOMERATE GREEN OR BLUE GREEN MANY CALCITE SEAMS ROCK IS FRESH AND SOUND BELOW 17' DEPTH. ONLY SLIGHT OXIDATION IN OCCASIONAL JOINTS BELOW 17' 6' THICK BROKEN ZONE AT 51'
EL. 1216.0
DRILL HOLE D-4
EL. 1079.0
43.0'
GRAVEL WITH OCCASIONAL BOULDERS
51.2'
VOLCANIC AGGLOMERATE GREENISH GRAY COLOR. FRESH ONLY SLIGHT OXIDATION ALONG JOINTS NUMEROUS CALCITE VEINS LOST DRILLING WATER AT 79'
EL. 984.8
DRILL HOLE D-9
EL. 1161.2
70°00'
TALUS
VOLCANIC AGGLOMERATE MANY CALCITE SEAMS & FRACTURES LOST DRILL WATER AT 7'
EL. 1105.6
DRILL HOLE D-12
EL. 1084.35
9.7'
BOULDERS, SAND & GRAVEL
88.90'
VOLC. AGGLOM. BROKEN, STAINED & FRACTURED IN SEVERAL PLACES
EL. 1045.70
DRILL HOLE D-17
EL. 1083.0
64.5'
GRAVEL & SOME BOULDERS
35.4'
VOLCANIC AGGLOMERATE GREENISH GRAY COLOR WELL FUSED HARD. NUMEROUS VEINS OF CALCITE LOST MOST OF WATER AT 87'
EL. 993.6
DRILL HOLE D-22
EL. 1092.5
58.5'
GRAVEL, BOULDERS, MOSTLY COURSE SAND & PEA GRAVEL WITH A FEW SMALL BOULDERS FROM 15' TO 24'
28.5'
VOLCANIC AGGLOMERATE GREENISH GRAY COLOR. HIGHLY FUSED, HARD. OCCASIONAL STREAKS OF CALCITE. MOST JOINTS SLIGHTLY STAINED NO DRILLING WATER RETURN BELOW EL. 1018.0
EL. 1006.5
DRILL HOLE D-24
EL. 1229.1
70°00'
NO OVER BURDEN BUT BADLY BROKEN AND WEATHERED FIRST FEW FEET VOLCANIC AGGLOMERATE MANY OPEN FRACTURES IN FIRST 15' OF CORE. SANDY TUFF 28.5' TO 31.0' OPEN JOINT AT 33.75'. 6" OF CALCITE LOST ALL WATER AT 89 FT.
104'
EL. 1126.0
DRILL HOLE D-5
EL. 1183.4
2.5'
BOULDER CORE NOT SAVED
51'
GREEN TO GREY VOLCANIC AGGLOMERATE PIECES UP TO 2" IN THE AGGLOMERATE LOST SOME DRILL WATER AT 31' HARD SILICIFIED TUFF AT 43' TO 45'
EL. 1129.4
DRILL HOLE D-13
EL. 1082.6
15.5'
GRAVEL & BOULDERS
22.8'
VOLC. AGGLOM. BROKEN, STAINED JOINTS
EL. 1044.3
DRILL HOLE D-18
EL. 1162.6
58°04'
TALUS BOULDERS UP TO 10' DIA.
EL. 1083.9
58.8'
BOULDERS & GRAVEL
26'
VOLC. AGGLOM. BADLY FRACT. & STAINED AT TOP CHANGING TO DENSE, HARD
EL. 999.1
DRILL HOLE D-19
EL. 1090.0
25'
BOULDERS & GRAVEL
40'
FINE GRAVEL & COURSE SAND
10'
MOSTLY BOULDERS
27'
VOLCANIC AGGLOMERATE GREENISH GRAY COLOR HIGHLY FUSED, HARD WITH A NUMBER OF CALCITE VEINS.
EL. 988.0
DRILL HOLE D-23
EL. 1123.0
46° 36'
VOLCANIC AGGLOMERATE GRAY BROWN & GREEN JOINTED EVERY FEW INCHES WEATHERED ALONG JOINTS. OTHER JOINTS RECEMENTED WITH CALCITE ZONE OF WEAK MATERIAL BETWEEN 63' & 77' LOST DRILLING WATER AT 80' RETURNED AT 120', LOST AGAIN AT 125'
165'
EL. 1002.5
RIVER GRAVEL
DRILL HOLE D-11 (45°)
EL. 1145.5
2'
12'
BROKEN & DECOMPOSED VOLC. AGGL. TALUS
MATERIAL ALL VOLCANIC AGGLOMERATE WITH MANY RECEMENTED SEAMS LOST WATER AT 36'
96'
EL. 1078.4
DRILL HOLE D-6
EL. 1123.0
55°00'
EL. 1273.0
69°00'
OVERBURDEN ASHY SILT WEATHERED ROCK
BLUE GREEN VOLCANIC AGGLOM. OPEN FRACT AT 17' BADLY FRACTURED BUT HOLDING WATER
50.2'
EL. 1221.5
DRILL HOLE D-14
EL. 1081.0
69.5'
BOULDERS & GRAVEL
24.5'
VOLC. AGGLOM. DENSE & HARD
EL. 987.0
DRILL HOLE D-20
EL. 1162.6
58°04'
TALUS BOULDERS UP TO 10' DIA.
VOLCANIC AGGLOMERATE GREENISH GRAY COLOR, HIGHLY FUSED, HARD. MANY CALCITE VEINS. NEARLY ALL JOINTS WEATHER STAINED DOWN TO 35' DEPTH. ONLY OCCASIONAL JOINTS STAINED BELOW 35' LOST DRILL WATER RETURN AT 98' NOTICEABLE WATER LOSS AT 275' OR WATER RETURN AT LEAST 80% BELOW 237'
EL. 1076.0
80'
SAND, GRAVEL & BOULDERS
VOLCANIC AGGLOMERATE WITH FINE SEAMS OF CALCITE, FRESH, NO OPEN OR ALTERED JOINTS
69.2'
EL. 946.8
DRILL HOLE D-8A
EL. 1123.0
55°00'
249'
VOLCANIC AGGLOMERATE GREENISH GRAY COLOR WELL FUSED, HARD NUMEROUS VEINS OF CALCITE 1/16" TO 1/2" THICK NUMEROUS JOINTS, MOST OF THEM WITH BROWN OXIDE STAIN. BROKEN CORE 35' TO 77' LOST DRILLING WATER AT 37', WATER RETURNED AT 175.5'
EL. 919.0
DRILL HOLE D-11 (55°)
EL. 1218.0
44°41'
8'
BOULDERS
68.2'
VOLCANIC AGGL. 55°00' GREEN GRAY HIGHLY FUSED HARD. BROWN SANDSTONE BETWEEN 46' TO 47.5', 61' TO 65' VERY BROKEN V.A. MANY STAINED JOINTS. 65' TO 78' BROKEN V.A. MANY STAINED JOINTS. DENSE V.A. BELOW 86' WATER RETURN REDUCING WITH DEPTH
EL. 1150.0
DRILL HOLE D-15 (45°)
EL. 1218.0
BOULDERS & SLOPE WASH
97'
VOLCANIC AGGLOMERATE BLUISH GRAY COLOR WELL FUSED HARD WITH MANY VEINS OF CALCITE BROKEN & WEATHERED TO 11'. VERY BROKEN AND WEATHERED ALONG JOINT 20' TO 22'. BROWN SAND STONE 55' TO 56.5' MOSTLY HARD, BUT WITH SOFT SEAMS BROWN SAND STONE 61' TO 64', HARD BANDED LAVA FROM 64' TO 71' VERY FINE GRAINED HARD. ABOUT 80% OF WATER RETURN AT COMPLETION OF HOLE
EL. 1133.0
DRILL HOLE D-15 (55°)
EL. 1084.2
4'
21'
BLUE GRAY VOLCANIC AGGLOMERATE WITH CALCITE SEAMS NO WATER RETURN BEYOND 2'
EL. 1032.8
DRILL HOLE D-11A
EL. 1078.5
80'
BOULDERS, GRAVEL & COARSE SAND
EL. 932.6
DRILL HOLE D-21
28'
VOLC. AGGLOM. FRESH JOINTS, MANY CALCITE SEAMS
EL. 970.5
DRILL HOLE D-16
FOR LOCATION OF SECTIONS SEE EXHIBIT L, SHEET 23
EXHIBIT L
SHEET 25
PROJECT Nº2173 IDAHO-OREGON
PLEASANT VALLEY H.E. DEVELOPMENT
DRILL HOLE LOGS - SHEET Nº1
SCALE: 1" = 20'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.
September, 1958.


DRILL HOLE D-25 (45°)
DRILL HOLE D-25 (0°)
DRILL HOLE D-25 (45°)
DRILL HOLE D-25 (60°)
DRILL HOLE D-28A
DRILL HOLE D-28B
DRILL HOLE D-27
DRILL HOLE PD-1
DRILL HOLE PD-2
DRILL HOLE DH-1
DRILL HOLE DH-2
DRILL HOLE DH-3
DRILL HOLE DH-3A
DRILL HOLE DH-3B
DRILL HOLE DH-4
DRILL HOLE T.H-1
DRILL HOLE P.H-1
VOLCANIC AGGLOMERATE GREENISH GRAY COLOR HIGHLY FUSED, HARD WITH MANY CALCITE VEINS. LOST DRILLING WATER AT 43'
VOLCANIC AGGLOMERATE GREENISH-GRAY COLOR HIGHLY FUSED, HARD WITH MANY THIN VEINS OF CALCITE. LOST DRILLING WATER AT 25'
VOLCANIC AGGLOMERATE GREENISH GRAY COLOR HIGHLY FUSED, HARD. LOST DRILLING WATER AT 55'
VOLCANIC AGGLOMERATE GREENISH GRAY COLOR HIGHLY FUSED HARD. CONTAINS MANY THIN CALCITE VEINS
BOULDERS, VOLCANIC ASH & GRAVEL
BROKEN VOLCANIC AGGLOMERATE W/ SEAMS FILLED WITH CALCITE
BROKE OUT INTO RIVER GRAVEL
BOULDERS
BOULDERS & SLOPE WASH
VOLCANIC AGGLOMERATE
VOLCANIC AGGLOMERATE LOST WATER AT 30'
VOLCANIC AGGLOMERATE LOST WATER AT 10'
VOLCANIC AGGLOMERATE LOST WATER AT 17'
SAND, GRAVEL BOULDERS
BROKE OUT INTO OVERBURDEN
VOLCANIC AGGLOM.
BROKE OUT INTO OVERBURDEN
VOLCANIC AGGLOMERATE
VOLC. AGGLOMERATE
OVERBURDEN ROCK GRAVEL
VOLCANIC AGGLOMERATE LOST WATER AT 70'
TALUS
VOLCANIC AGGLOMERATE
BOULDERS & GRAVEL
STAINED PARTLY DECOM.
HARD DENSE VOLC. AGGLOM.
HOLES MARKED - DH- ARE TAKEN FROM USSR GEOLOGICAL INVESTIGATIONS
EXHIBIT L
SHEET 26
PROJECT Nº2173 IDAHO-OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
DRILL HOLE LOGS SHEET Nº 2
SCALE: 1"=50'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.
FOR LOCATION OF SECTIONS SEE EXHIBIT L, SHEET 23
September, 1955
D-140634
908

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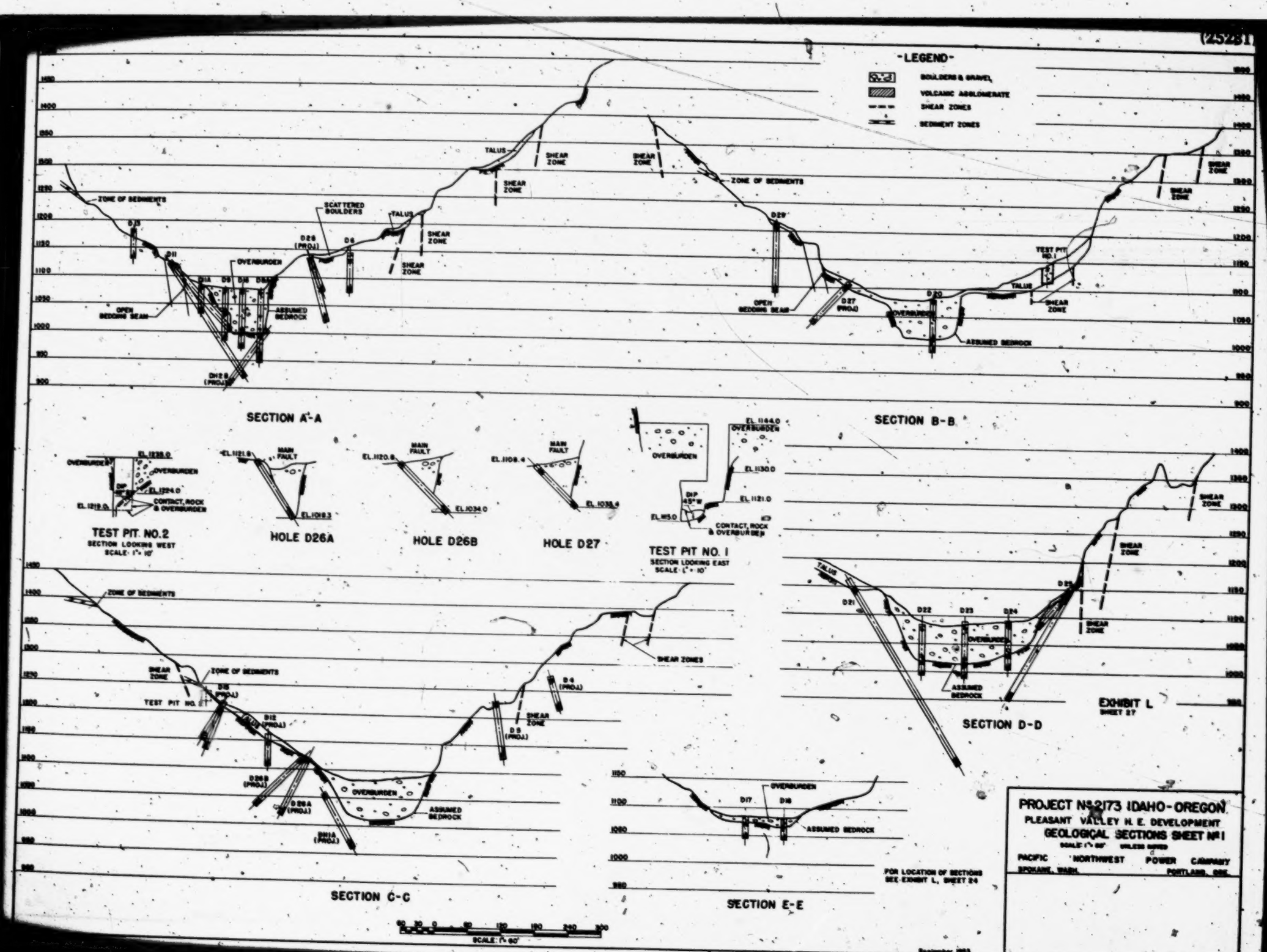


PROJECT No. 2173 IDAHO-OREGON

PLEASANT VALLEY H. E. DEVELOPMENT

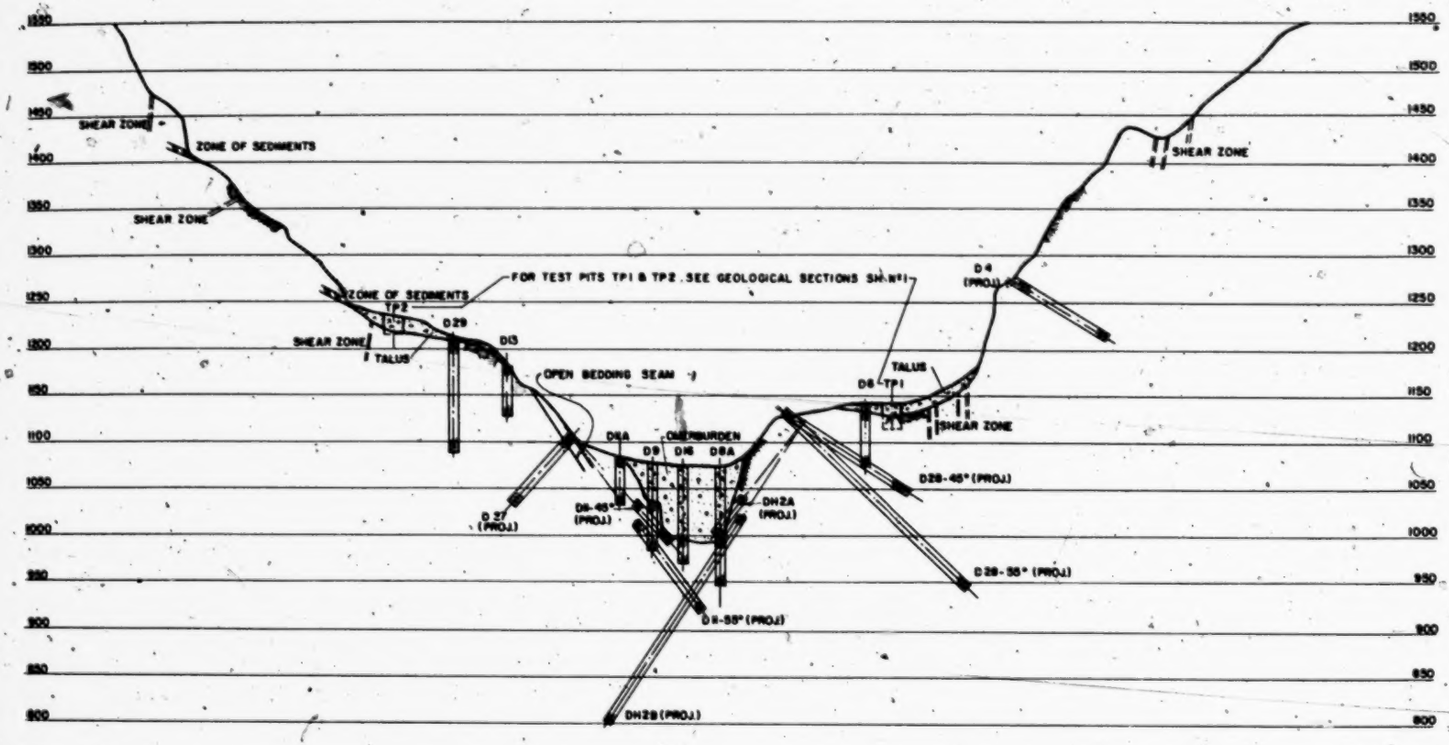
GEOLOGICAL SECTIONS SHEET Nº 1

SCALE: 1" = 60' UNLESS NOTED

PACIFIC NORTHWEST POWER COMPANY

SPOKANE, WASH. PORTLAND, ORE.

September, 1953



SECTION F-F
ALONG ℄ TOP OF DAM
LOOKING DOWNSTREAM

60 0 60 120 180 240 300
SCALE: 1"=60'

LEGEND

- BOULDERS & GRAVEL
- VOLCANIC AGGLOMERATE
- SHEAR ZONES
- SEDIMENT ZONES

EXHIBIT L
SHEET 23

FOR LOCATION OF SECTIONS
SEE EXHIBIT L, SHEET 24

PROJECT N°2173 IDAHO-OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
GEOLOGICAL SECTIONS-SHEET N°2
SCALE: 1"=60'

PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

September, 1955.

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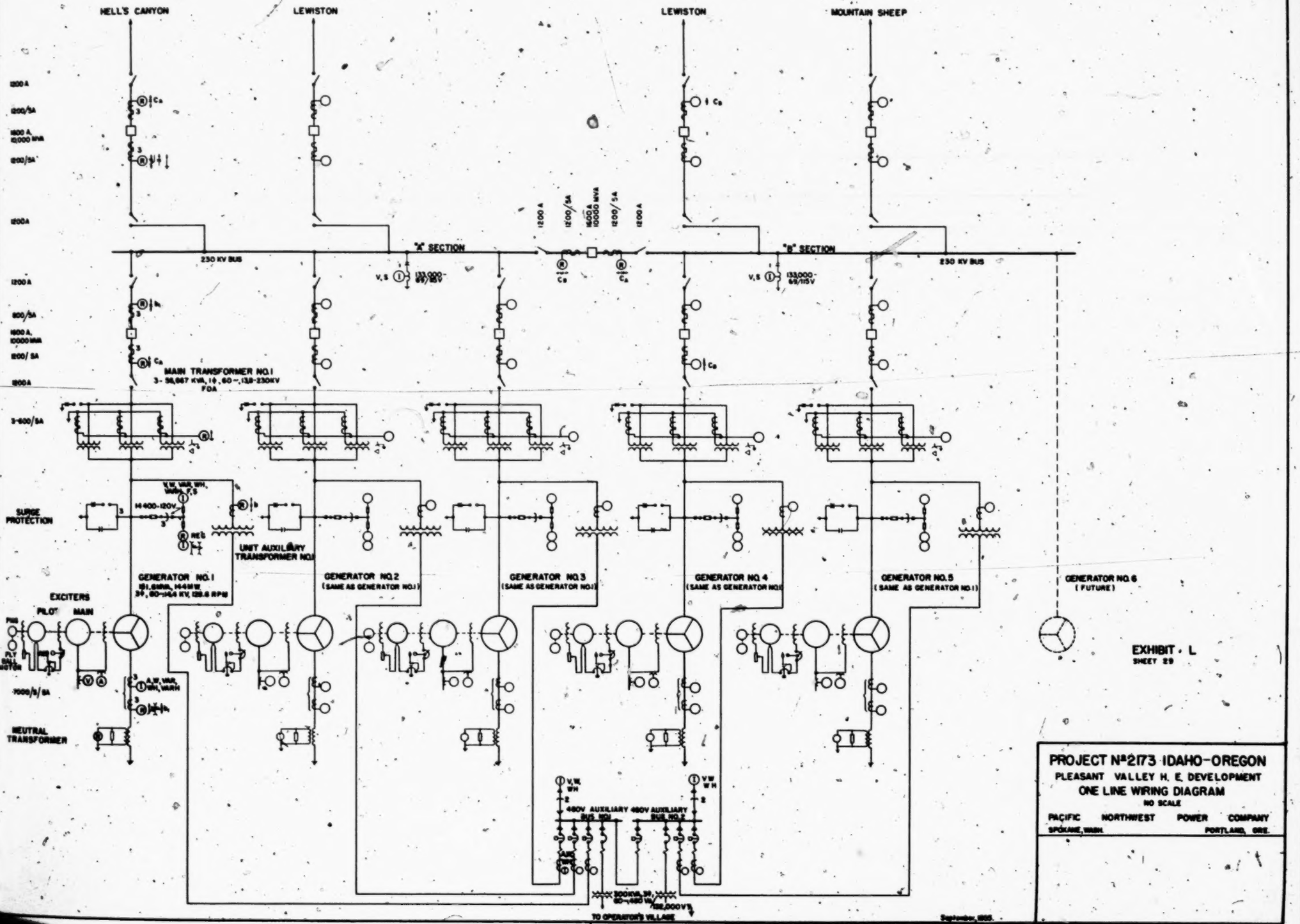
HELL'S CANYON
LEWISTON
LEWISTON
MOUNTAIN SHEEP
"A" SECTION
"B" SECTION
230 KV BUS
230 KV BUS
MAIN TRANSFORMER NO.1
3 - 58,667 KVA, 10 , 60 -, 13.8-230KV FOA
SURGE PROTECTION
UNIT AUXILIARY TRANSFORMER NO.1
GENERATOR NO.1
GENERATOR NO.2
(SAME AS GENERATOR NO.1)
GENERATOR NO.3
(SAME AS GENERATOR NO.1)
GENERATOR NO.4
(SAME AS GENERATOR NO.1)
GENERATOR NO.5
(SAME AS GENERATOR NO.1)
GENERATOR NO.6
(FUTURE)
EXCITERS
PILOT
MAIN
NEUTRAL TRANSFORMER
480V AUXILIARY BUS NO.1
480V AUXILIARY BUS NO.2
TO OPERATOR'S VILLAGE
EXHIBIT - L
SHEET 29
PROJECT Nº2173 IDAHO-OREGON
PLEASANT VALLEY H. E. DEVELOPMENT
ONE LINE WIRING DIAGRAM
NO SCALE
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.
September, 1955.
G-140537